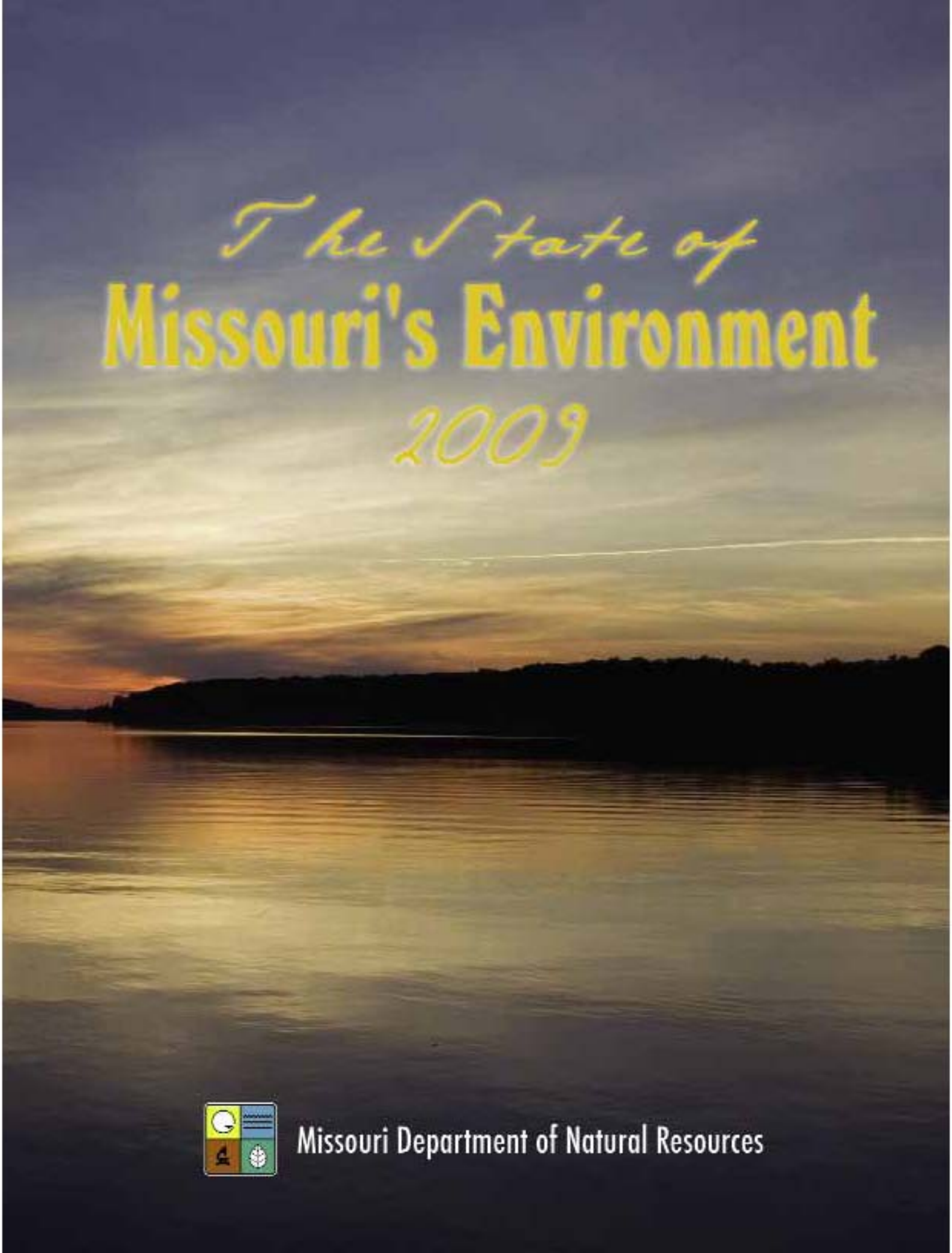

The State of
Missouri's Environment
2009
Missouri Department of Natural Resources

Director's Message

Welcome to the The State of Missouri's Environment: 2009, which presents a summary of accomplishments and challenges for Missouri's natural resources. The accomplishments presented in the report were those achieved in conjunction with Missouri citizens. Similarly, we must all face the future challenges presented here together to find the most effective solutions.

The Missouri Department of Natural Resources has aggressively pursued a compliance assistance initiative to make it easier for Missourians to participate in these efforts. In 2005, the department established an Ombudsman Program to help strengthen the department's relationships with Missouri's communities, businesses and individuals; to facilitate communication between staff and Missourians; and to make technical and financial assistance readily available to those who need it. The ombudsmen and I have held more than 100 town hall meetings with more than 1,670 Missourians across the state.

The department has also made its Web site, www.dnr.mo.gov, more user-friendly. Most recently, we added a Community Assistance Portal at www.dnr.mo.gov/assistance/ and a simplified online Environmental Concern Form, www.dnr.mo.gov/concern.htm, to help Missourians quickly find the information they need and to communicate with us.

Our Field Services Division oversees our expanded network of satellite offices and our environmental assistance visits. During these visits, staff from our department visit permitted sites and walk permit holders through their unique requirements. Compliance assistance is provided with the expectation that corrections will be made if the department discovers any problems. Efforts to help citizens comply with environmental regulations are working, and it shows in the cleaner air, land and water that we all enjoy.

Though we've celebrated many successes, we must look to the future to sustain those successes. Re-evaluating our funding structure will be an important part of this process. As a result of many pieces of environmental legislation passed over the last 20 years, about 50 different funds make up the funding structure for the Department of Natural Resources today. Because of the need to monitor and improve environmental regulation and the need to fund such programs, fees were developed based on a "polluter pays" philosophy. Today, however, more people do a better job of protecting our environment. Permit holders pay more for doing a better job, so the polluter pays philosophy is seeing a diminished return. It is highly likely that the fees paid by business and industry are ultimately borne by the consumer. Also, the department must approach the General Assembly each year to seek fee increases as previous fees sunset.

DNR Director Doyle Childers visits with Ron Greenwood, manager of the Fair Grove wastewater treatment plant.

Proposals to fund environmental efforts by replacing those fees with some tax which would be approved by the public, might receive considerable support from public and private entities. This could include a concentrated effort to eliminate backlogs of permitting actions and continuing to automate and streamline the permitting process. This funding would go toward environmental services to the public rather than be spent on the considerable administrative costs for handling these multiple fees. There is a great need for discussion concerning how we fund environmental services in Missouri.

A reliable funding process also offers the department an opportunity to have a strategic plan drive the DNR budget, so we are better prepared to adjust to the demands of external circumstances.

Recently, we began the process of installing a new administration for our state and nation. Each administration provides new direction and opportunities to carry out our responsibilities as individuals and as an agency. I am very pleased with what we have been able to accomplish, and it has been a privilege to work with you on the many efforts that impact your quality of life. I have very much enjoyed my time serving each of you as director of the Department of Natural Resources. Together, our achievements have made Missouri a better place to live and work.

I wish you the best as the agency moves forward, under new leadership, in protecting our state's natural resources.

Doyle Childers

Director, Missouri Department of Natural Resources

table of contents

All photos taken by Scott Myers, Missouri Department of Natural Resources, unless otherwise indicated.

Left: Purple coneflowers at Cuivre River State Park.
Cover: Sunset on Mark Twain Lake in northeast Missouri.

Compliance Assistance, Access and Improvements

Ombudsman Don Summers, left, meets with Vern Kincheloe, general manager of Macon Municipal Utilities at NEMO Grain LLC in Macon.

Environmental Assistance Visits

Since early in 2005, when Director Doyle Childers introduced the concept of "compliance assistance," the Department of Natural Resources has reached out to help Missourians meet their environmental obligations.

One of the first steps taken to implement compliance assistance was to develop a system to better explain to those who hold department permits exactly what those permits require of them. That system, first referred to as "initial assistance visits," has grown, evolved and been renamed "environmental assistance visits."

The purpose of these visits is for permit recipients to receive a visit from a department staff member. These visits, which are scheduled in advance and completely voluntary on the part of the permit holder, give the staff member an opportunity to explain the requirements of the permit and to tour the facility to point out areas of concern. It also gives the permit recipient an opportunity to ask questions.

These are not formal inspections and only in the rare cases in which an immediate or imminent threat to human health or the environment is discovered are the visits upgraded to inspections.

At first, these visits were targeted exclusively at facilities receiving a new permit, registration or certification. As the practice began seeing more success, the department expanded it to include facilities receiving permit reissuances or modifications, changes of owners or operators, and any other cases where it would be helpful for the facility operator or owners to have environmental questions answered.

During Fiscal Year 2008, which ran from July 1, 2007, through June 30, 2008, regional office staff conducted 4,282 environmental assistance visits, pushing that total to nearly 10,000 conducted since January 2006.

Satellite Offices

Although not yet as numerous as some ubiquitous chains of discount stores or coffee shops, Department of Natural Resources satellite offices continue to grow in number throughout the state, bringing department staff closer to the people and issues of Missouri. During 2008, the department's Northeast Regional Office in Macon opened three new satellites: Boonville, Kirksville and Hannibal.

The Boonville Satellite Office, located in the Katy Trail Depot, 320 First St., is home to four Northeast Regional Office staff. Their work will include providing inspection and investigation field services for water and air issues in Cooper and nearby counties.

The Kirksville Satellite Office, which is located on the campus of Truman State University, houses one staff person who provides engineering and inspection services related to waste water facilities in Adair and nearby

counties and works with the university on cooperative projects.

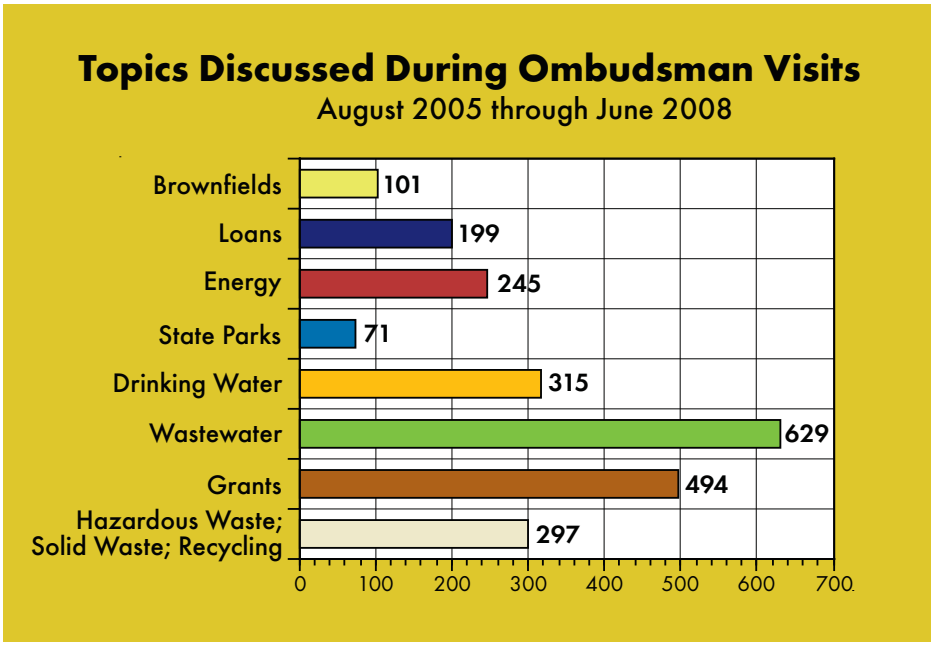
The Hannibal Satellite Office, which was previously located at Wakonda State Park, is now found in the Missouri Department of Transportation District 3 Office, 1711 S. Highway 61. The department employee at this site will focus primarily on water pollution issues in the northeast Missouri counties that border the Mississippi River. That person also will work with the Missouri Department of Transportation on environmental issues.

With the addition of the Boonville, Kirksville and Hannibal satellite offices, the Field Services Division, through the department's five regional offices, operates 17 satellite offices.

Ombudsman Program

The Department of Natural Resources' Ombudsman Program was established in August 2005 to help strengthen the department's relationships with Missouri's communities, businesses and individuals; to facilitate communication between staff and Missourians; and to make technical and financial assistance readily available to those who need it. Since inception of this program, ombudsmen have made more than 6,500 site visits.

Through the program, an ombudsman is located at each of the five regional offices and the department's Division of Geology and Land Survey Office in Rolla, and operates independently from these offices and the department's other divisions. Ombudsmen communicate with the programs, divisions and regional directors, as well as the department director, regarding issues, concerns and problems they learn of while meeting with Missouri citizens. Nearly a quarter of the ombudsmen's visits result in follow-up assistance from staff in the programs or regional offices.



Facilitating Communication

The ombudsmen, along with the department director, have conducted town meetings across Missouri to answer questions and gain input from citizens, business leaders and city officials. The ombudsmen have facilitated more than 120 town hall meetings with more than 1,800 attendees. These meetings have provided citizens an opportunity to ask questions, discuss concerns and learn more about our department and its services.

Several county health agencies contacted one of the ombudsmen and requested a better way to communicate with the Department of Natural Resources. They wanted clarification on how regulatory responsibilities were divided between the department and county health agencies. For example, county public health agencies regulate any onsite sewage disposal systems for single-family residences, including any lagoons that receive less than 3,000 gallons of sewage per day. The Department of Natural Resources regulates all sewage disposal systems more than 3,000 gallons per day, plus any lagoons less than 3,000 gallons per day for any commercial establishments. Both the Department of Natural Resources and local county health agencies also regulate certain food service establishments that are also public water supply systems in some places.

One local health administrator suggested that the department host a meeting to discuss better coordination on these types of issues, so the department's Southeast Regional Office brought together staff from the departments of Natural Resources and Health and Senior Services, along with 36 officials from 20 local county public health agencies. In all, 65 people met in Poplar Bluff to discuss a range of issues.

The meeting was so successful that other ombudsmen in the department helped to organize similar meetings with county health departments in Springfield, Kansas City and Macon. Local and state officials came together to address issues like open burning, ille-

Ombudsman Carrie Smith, right, with Christian County Clerk Kay Brown.

Home page for the department's successful online Permit Assistant.

gal dumping, water sampling and more effective ways to alert the public when a boil water order has been issued.

When an ombudsman read an article in a local paper about Carbolytic Materials Co. and the company's proposal to build a plant in Maryville, she spoke with the director of the department's Kansas City Regional Office about offering CMC a pre-permit planning meeting. CMC plans to construct a plant that would extract carbon black, the reinforcing agent found in tires, by melting used tires in an environmentally friendly vacuum. At the ombudsman's suggestion, department officials met with city and county officials and representatives of the company to discuss the type of permits that would be required for an operation of this nature. The new plant will bring many jobs to northwest Missouri and puts scrap tires to good use. By arranging a meeting with company representatives early in the process, the ombudsman and regional office staff helped ensure that all this will be accomplished in an efficient and effective way that will also protect Missouri's natural resources.

Environmental Initiatives

The department's ombudsmen have provided support to communities looking to make improvements to ailing infrastructure systems, business owners seeking assistance in meeting environmental standards, citizens working to address problems in their communities and a range of other issues. The ombudsmen have spoken to more than 980 individuals who have praised the working relationship they have with the department and its staff. The ombudsmen are an important resource for both the public and the department, helping put Missourians in touch with the appropriate staff within the agency. These visits also help the agency educate the public on programs designed to improve the environment.

The ombudsmen helped promote the department's Tire Dump Roundup Program, which allows private property owners to self-report tire dumps on their property and have them cleaned up for free. Missouri has also recovered 12,329 mercury switches from scrap vehicles since our state joined the End of Life Vehicle Solution Program, or ELVS, in November 2006. Our department's ombudsmen played a significant role in the success of this program by personally visiting 196 salvage operations to encourage their participation.

The ombudsmen worked to encourage the recycling of used mercury-switch thermostats. They met with 117 HVAC contractors and wholesalers to let them know about the Thermostat Recycling Cooperative, a private cooperative established by Honeywell, General Electric and White-Rodgers that accepts and recycles wall-mounted mercury thermostats.

The ombudsmen also assisted the department's Energy Center in taking a program designed to improve household energy efficiency and using it to reduce mercury emissions as well. Through Kansas City Power and Light's Energy Optimizer program, homeowners save energy and money by replacing their old thermostats with new ones that are programmable. Once KCP&L installs the programmable thermostat, the old one is left with the homeowners in case they change their minds. In just the first two years of this highly successful program, more than 18,000 homeowners chose to participate. But one ombudsman who happens to also be a customer of KCP&L wondered, what happens to the old thermostat, which often contains high levels of mercury, when the homeowner realizes the tremendous energy savings of the programmable thermostat and decides to keep it? The ombudsman brought the issue to the attention of staff in the department's Energy Center and representatives of KCP&L. Together, KCP&L and the department's Energy Center began developing a plan to ensure the old thermostats are disposed of properly, which will help ensure that these dangerous mercury emissions don't make their way into our air, land and water. With permission from the homeowner, technicians now take the old thermostats and dispose of them through the local thermostat recycling center. KCP&L is developing a long-term plan that would continue to ensure safe disposal of the unused thermostats.

The ombudsmen also have visited home and building supply companies and lumber yards, which often receive questions from homeowners and contractors. The ombudsmen have provided brochures and fact sheets that explain the type of permits that are needed to begin a project as well as helpful information regarding removal of asbestos and other construction/demolition debris. This initiative benefits both the building supply business and the individual performing the construction or renovation project.

Environmental Lingo

303(d) List: A tool used to help state and federal agencies keep track of waters that are not meeting water quality standards. Once a body of water is added to the 303(d) List, the department develops and implements a study to correct the water impairments. (See Total Maximum Daily Load)

Alternative Fuels: Substitutes for traditional liquid, oil-derived motor vehicle fuels like gasoline and diesel. Includes mixtures of alcohol-based fuels with gasoline, methanol, ethanol, compressed natural gas and others.

Aquifer: A geologic structure or unit that contains sufficient saturated permeable material to provide water to wells and springs

Biofuels: Fuels made from biomass such as herbaceous and woody plants, agricultural and forestry residues, and a large portion of municipal solid and industrial waste.

Biosolids: The solid or semi-solid (non-liquid) portion of animal wastes. These nutrient-rich organic materials result from the treatment of domestic sewage in a treatment facility. When treated and processed, these residuals can be recycled and applied as fertilizer to improve maintain productive soils stimulate plant growth.

Biomass: A plant matter such as trees, grasses, agricultural crops or other biological material that can be converted to energy. This includes all of the living material in an area, but most often refers to vegetation.

Best Management Practice (BMP): Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources.

Bond: A financial instrument sold to provide funds for drinking water and wastewater construction projects.

Brownfields: Abandoned, idled or under-used industrial and commercial facilities or sites where expansion or redevelopment is complicated by real or perceived environmental contamination. They can be in urban, suburban or rural areas. The department's Brownfields/Voluntary Cleanup Program helps communities ease potential health risks and restore the economic viability of such areas or properties.

Btu: British Thermal Unit.

Carbon (CO2) Sequestration: Emerging technology to capture and confine carbon dioxide (CO2) gas emissions from coal-fired power plants into underground rock formations.

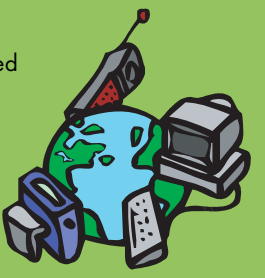
Clean Air Interstate Rule (CAIR): A rulemaking designed to ensure that all Americans continue to breath cleaner air by dramatically reducing air pollution that is transported regionally in 28 eastern states.

Clean Air Mercury Rule (CAMR): Builds on CAIR to significantly reduce emissions from coal-fired power plants, which are the largest remaining sources of mercury emissions in the country.

Concentrated Animal Feeding Operation (CAFO): Agricultural facilities that house and feed a large number of animals in a confined space for a limited period of time.

Downtown Revitalization and Economic Assistance for Missouri Initiative (DREAM): Designed to help communities engage in downtown redevelopment and revitalization. It also supports and broadens historic preservation efforts.

Environmental Assistance Visit (EAV): These voluntary, scheduled visits are designed to help facility operators and businesses understand what is expected of them and to help them meet those expectations by walking them through the requirements of their permits.



Electronic Scrap (e-scrap): Unwanted TVs, computers, monitors, keyboards, mice, printers, hand-held devices, cell phones and related electronic equipment.

Ethanol: An alternative automotive fuel derived from grain and corn; usually blended with gasoline to form gasohol.

Geographic Information System (GIS): A system of hardware and software used for storage, retrieval, mapping, and analysis of geographically referenced data.

Geographic Reference System (GRS): A network of accurately positioned horizontal and vertical control monuments (latitude, longitude, elevation and state plane coordinates) used by land surveyors, engineers, cartographers and others who have a need to locate precise positions on, below or above the surface of the earth.

Grant: State and/or federal funds provided to an eligible applicant to assist with a variety of environmental initiatives.

Greenhouse Gases: CO2, methane, nitrous oxide and fluorinated gases (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). Produced by combustion processes such as burning coal, diesel fuel, gasoline, natural gas, wood and waste materials.

Ground-Level Ozone: An irritant that damages lung tissue, aggravates heart and respiratory disease and can even cause problems for healthy individuals who spend a significant amount of time outdoors. Ground-level ozone is also a harmful part of what is sometimes referred to as "smog."

Groundwater: Water found below the earth's surface at various depths where void spaces in soil, sediment or rock are filled with water.

Infrastructure (Water/Wastewater): The extensive network of drinking water plants, distribution lines, sewer lines and wastewater treatment plants that provide the public with access to water and sanitation.

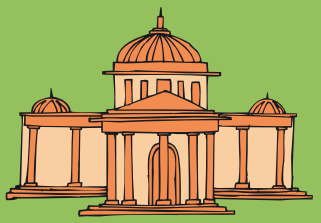
Leadership in Energy and Environmental Design (LEED): LEED certification, administered by the U.S. Green Building Council, rates projects based on five criteria: site sustainability, energy and atmosphere, indoor environmental quality, material and resources, and water efficiency.

Missouri Environmental Geology Atlas (MEGA): Interactive computer maps published by the department on a CD-ROM. These maps provide interested users with more than 30 statewide GIS data layers.

Missouri Risk-Based Corrective Action Technical Guidance: A process that gives property owners more flexibility in managing contaminated properties and makes cleanups of hazardous sites potentially less expensive.

Nonattainment: Used to describe a region that fails to meet federal standards for a specific pollutant.

National Ambient Air Quality Standards (NAAQS): A system of measuring air quality established by the EPA under the federal Clean Air Act. These standards were established by the EPA and apply to outdoor air quality throughout the United States.



National Register of Historic Places: The nation's honor roll of historically significant resources.

Particulate Matter: "Particulate matter," also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals and soil or dust particles.

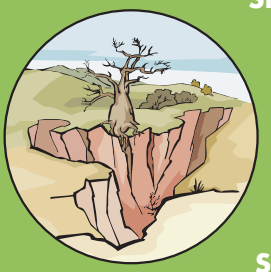
Point Source Pollution: Pollution that comes from a single point, such as a pipe.

Nonpoint Source Pollution: A type of pollution that does not come from specific discharges. Runoff from agriculture, urban areas and abandoned mine lands are all typical examples of this type of pollution.

Prevention of Significant Deterioration (PSD): A type of construction air permit.

Radionuclide: Radioactive particle, manmade (anthropogenic) or natural, with a distinct atomic weight number. It can have a long life as a soil or water particle.

Renewable Energy: Energy sources that are based on natural cycles and are replenished in a relatively short timeframe. Common examples include solar, wind and biomass energy sources.



Sinkhole: A depressed area usually occurring in limestone regions and formed by solution of bedrock and subsequent undermining of sediment into caves. Sinkholes range in size from several square yards to hundreds of acres. They may be quite shallow or hundreds of feet deep.

State Revolving Fund (SRF): A program through which the U.S. EPA makes capitalization grants available to each state, enabling the states to maintain a perpetual water pollution control revolving loan fund that provides financial assistance for construction of wastewater treatment facilities.

Soy-based Biodiesel: Soy-based fuel blended with traditional diesel.

Superfund: A federal law that provides both response and funding mechanisms for the cleanup of hazardous substances and disposal sites.

Surface Water: Water typically associated with precipitation run-off. This includes rivers, streams, lakes and ponds.

Tire-Derived Fuel: Fuel used in power plants that has been derived from scrap tires.

Total Maximum Daily Load (TMDL): If a body of water is added to the 303(d) List, the department develops and implements a study to correct the water impairment, often a TMDL document. The TMDL describes the maximum amount of a pollutant that may enter a water without violating water quality standards.

Underground Storage Tank: A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals.

Volatile Organic Compounds (VOC): React with nitrogen oxide on hot, summer days to form ground-level ozone.

Weatherization: Making improvements to a home, business or other type of building to reduce the structure's energy bills through improved energy efficiency. This term is also often used to describe the Low Income Weatherization Assistance Program.

Wetland: An area of land that is wet at least part of the year; often a transition between dry land and open water.

E.A. Pape Lake near Concordia.

Clean water is a shared resource – the water quality decisions we make in Missouri can affect more than just Missouri's quality of water and precious soil resources. Earth is a water planet, and thousands of pollution sources can impair our soil, groundwater and surface water quality. This has far-reaching consequences for all Missourians, as well as our neighbors.

There is a great deal of overlap between the risks that can threaten our land and those that pose a threat to our water. The consequences of our choices are interconnected. Across Missouri, schools, universities, businesses, local governments, elected officials, community groups and private citizens work to protect water quality and availability on several fronts. These include: preventing or controlling discharge of pollution to our rivers, lakes and streams and groundwater; reducing soil erosion; developing a state water plan to ensure adequate water resources; and engaging other states and the federal government to maintain the future beneficial uses of interstate water for each and every Missouri citizen.

Soil Erosion

When soil enters Missouri's waters in amounts greater than those received through natural processes, it can have a negative effect on aquatic life. As soil is washed away from the land, it can also bring pollutants such as pesticides and fertilizers with it. Some of these chemicals can remain in the water all the way to the Gulf of Mexico. By preventing soils and water that contain agricultural chemicals from entering Missouri's streams, rivers, lakes and water supply reservoirs, we can protect the quality of Missouri's water and the waters flowing through the states downstream of us.

Over the past 23 years, soil conservation programs have helped Missouri landowners keep more than 162.7 million tons of soil from eroding into the waterways of our state. Currently the rate of soil erosion in Missouri is 5.3 tons per acre per year. Soil erosion is above acceptable levels on 5 million acres in the state.

The Soil and Water Districts Commission also has responded to the growing need to address the water quality issues within the soil and water conservation equation. Agriculture is totally dependent upon water and in turn affects the quality and quantity of water leaving agricultural land. Conservation practices lead to greater water infiltration and less runoff and erosion.

Increased funding to local soil and water conservation districts will increase the rate of installation of traditional practices, such as terraces, grassed waterways and ponds, and also provide incentives and technical assistance to landowners to implement practices designed specifically to improve water quality.

Properly implemented practices, such as nutrient and pest management, will reduce chemical runoff and result in improved water quality in Missouri's streams and rivers and reduced production costs for landowners.

Recent improvements within the department's Soil and Water Conservation Program have streamlined the process of providing almost $27 million from the parks, soils and water sales tax to implement soil and water conservation practices to control erosion and protect water resources in all

114 of Missouri's counties. Landowners will have access to $26.6 million in fiscal year 2010, which is an additional $1.2 million over the $25.4 million available in fiscal year 2009.

In 1984, 1988, 1996 and 2006, Missourians voted to support the parks, soils and water sale tax that finances activities by the department's Soil and Water Conservation Program and the Missouri state park system.

Over the years, there was a gradual decline in the percentage of funds directed to cost-share practices and an increase in the percentage of funds going toward administration of the program and the districts. Business efficiencies with the Soil and Water Conservation Program have allowed the department to increase the funding available to landowners while providing increased funding to improve district employees' salaries and benefits at the same time.

In the fiscal year 2010 budget, 62 cents of every tax dollar dedicated to soil and water conservation will be used for erosion-control practices, an increase from 59 cents over the previous budget. These erosion-control practices fight the loss of topsoil, which affects everyone. Missouri loses about 71 million tons of soil each year, and thinner topsoil decreases the productivity of soil. This loss of soil productivity to agricultural landowners means higher prices for consumers.

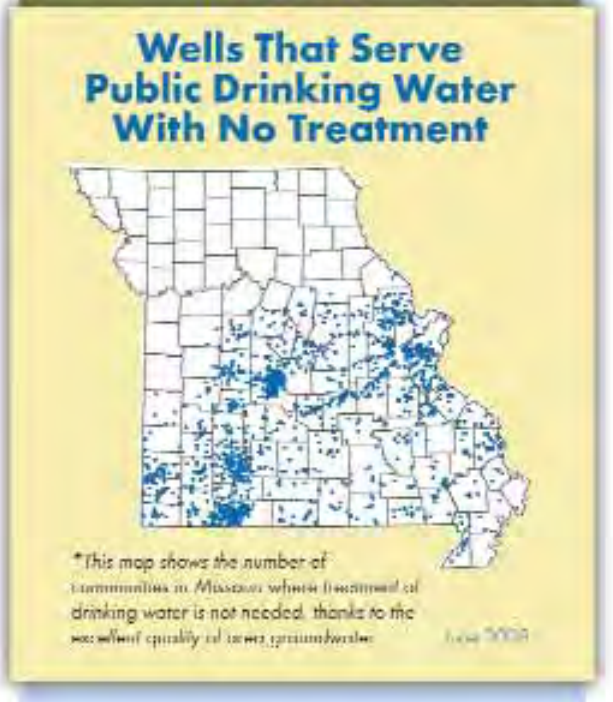
Since the initial passage of Missouri's parks, soils and water sales tax in 1984, the Department of Natural Resources has provided $463 million to Missouri agricultural landowners to protect the state's soil and water resources.

In addition, revenues from the tax have allowed Missouri to decrease its rate of soil erosion more than any other state in the United States.

Drinking Water

About 86 percent of Missourians are served by public water systems. The other 14 percent use domestic or multi-family

A new water tower under construction in Craig.



wells. In 2007, 90.6 percent of community populations met health-based standards. The public water systems that violate health-based standards typically are non-community systems and serve a small percentage of Missouri's population. The department therefore focuses both assistance and compliance efforts on these smaller systems to ensure that all Missouri citizens drink water that is safe.

Missouri's overall high compliance rate can largely be attributed to our good quality groundwater. Missouri does not have some of the naturally occurring contaminants like arsenic that pose challenges in other states. Most of our water is not naturally corrosive so issues related to lead and copper pipe have not been a major problem here. Nitrates and pesticides have not been found in the deep groundwater used by public water systems. Our large rivers and a number of reservoirs are the resources that serve our major population centers.

While the pesticide atrazine was a problem at about a dozen surface water systems in the mid 1990s, effective treatment and good source water protection has practically eliminated this serious health problem.

Missouri is enhancing its emphasis on source water protection by making guidance documents more user-friendly and more accessible, developing a source water protection Web page, grant program and implementing other protection plans.

Aging infrastructure continues to pose a significant challenge to maintaining safe drinking water in Missouri. Failing pipes compromise drinking water quality by allowing contaminants to enter the system, posing a serious health threat. This need can be addressed through funding for improvements; modeling to identify problem areas; inspections for leakage, corrosion and cross-connections; and drinking water facility improvements and asset

Missouri Risk-Based Corrective Action is:

- cleanup based on risk.
- risk dependent on exposure.
- exposure dependent on contaminants, routes of exposure and targets.
- Flexible to tailor cleanup plan to address site-specific conditions and goals.
- long-term stewardship to ensure future risks are actively managed.

"MRBCA is a flexible process to manage contamination based on the risks the contamination poses to human health and the environment now and in the future."

management plans.

The development of small subdivisions also poses a risk to drinking water quality. Developers of some subdivisions plan their developments so that each drinking water source serves less than 15 connections or 25 people, thus avoiding regulation as a public drinking water system. Also, if or when the subdivision grows to the point of meeting the definition of a public water system, the homeowners association or other responsible party – not the developer – becomes subject to the drinking water law and regulations and may be liable for costly repair of the system or treatment of the water. The department is focusing on this issue.

Groundwater

Groundwater is one of Missouri's most important natural resources. About 44 percent of Missouri's population relies on groundwater as their source of drinking water. Most public drinking water supply wells and many private wells are deep, properly cased and properly grouted. Some older, inferior quality private wells are shallow, not properly cased, nor properly grouted. More than 6,500 new water wells are drilled each year in Missouri; however, the department estimates that less than 80 percent of these wells are properly certified, and more than 300,000 abandoned wells remain unplugged. Septic tanks, feedlots or even chemical handling sites located near improperly cased wells can easily contaminate them. By properly constructing and maintaining wells and encouraging aquifer protection, we ensure safe drinking water for future generations and protect groundwater.

Missouri's aquifers contain an estimated 500 trillion gallons of fresh water. Despite this tremendous resource, groundwater overuse in some areas has caused groundwater levels locally to decline tremendously. The levels in Noel, located in McDonald County, have dropped as much as 400 feet in the past 40 years. Parts of Springfield and the Joplin/Webb City/Carthage areas experience seasonal problems as well. Prolonged drought conditions have contributed to lower groundwater levels in several regions.

Fortunately, most areas have experienced much less groundwater-level change. In the past, chemical wastes and other contaminants dumped at factories and other facilities have threatened groundwater. The department aggressively investigates groundwater contamination at these sites and pursues cleanups, if necessary. The Missouri Risk-Based Corrective Action process is used to provide a consistent and reasonable approach for managing site risks. However, it often is impossible to remove all contaminants at these sites. The department's long-term stewardship efforts are important during these situations.

Radionuclides

Community water systems are required to test for radionuclides. A running annual average of quarterly samples is used to determine system compliance. The most common sources of radionuclides in groundwater are naturally occurring radioactive minerals in subsurface rock formations, generally due to uranium and radium deposits. Water from wells drilled into such rock formations may contain radionuclides, which dissolve in water. Radionuclides exist in groundwater in certain areas in Missouri. In some areas they exceed drinking water standards for radioactivity. Most recent data shows that only 1.8 percent of Missouri's community water systems are currently exceeding standards for gross alpha or combined radium isotopes.

In an effort to protect public health, the water systems are required to test the water at the point where it enters the distribution system. The department is working with these local water systems to bring them back into compliance. Reduced monitoring is allowed for systems with very low contaminant levels.

Radionuclides in public water systems are a health concern. Some people who drink water containing radionuclides in excess of the standard over many years may

Commission Working to Help Communities Meet Water Needs

In its early stages, the North Central Missouri Regional Water Commission formed to assess the severity of the region's dwindling water supply, a consequence of cyclical droughts and northern Missouri's poor groundwater quality and quantity. These conditions leave local communities with a severe shortage of drinkable water. They are forced to rely on surface water impoundments for water resources. The commission undertook an in-depth needs and feasibility study conducted by Burns & McDonell Engineering, assisted by the Missouri Department of Natural Resources and funded through a grant obtained by U.S. Senator Kit Bond.

The commission decided the best way to address this daunting problem was to construct a 2,300-surface-acre lake to serve a multi-county region of northern Missouri. When completed, the project will include a plant to treat the lake water, which will then be transmitted as potable water to its wholesale members for distribution.

The commission has worked to secure loans from the Department of Natural Resources, the U.S. Department of Agriculture Rural Development and other government agencies. The commission also worked with Sen. Bond, who helped to secure the federal funding necessary to finance the project through the USDA Natural Resources Conservation Service's state office. The commission has coordinated with several federal and state agencies for compliance and oversight, as well as assisting in the numerous engineering and testing aspects of the project. Most recently, the commission has overseen survey work and implemented an accounting system. The commission also initiated a water treatment study through the department for transition from chlorine to chloramine treatment at the commission's water plant.

Between March 2005 and March 2008, the commission grew from two organizational members to five member communities and rural water districts contracting to purchase water from the regional water commission, as well as three additional associate members. These eight members serve in six of the ten counties recognized as in need of an additional or new, reliable water resource. It is anticipated additional new members will continue to join the regional water commission in the near future.

When this project began, communities and rural water districts in ten Missouri counties faced shrinking water supplies that were shrinking their economies as well. With water resources scarce and unreliable, new businesses were afraid to set up shop. Through the North Central Missouri Regional Water Commission, the office of U.S. Senator Kit Bond, the Missouri Department of Natural Resources, the USDA and other state and federal agencies, these communities will soon be able to purchase water wholesale for their consumers. Centralizing these resources will avoid duplication of services. Utilizing economies of scale will also save money for participating communities, water districts and federal and state agencies.

As the project transitions into the design phase of the reservoir, the extension of transmission lines and a new elevated water tower for present and new members, communities and rural water districts in this region of northern Missouri move closer to a secure water supply. A region that has struggled for years through water shortages is looking forward to a more plentiful and reliable water supply for its future.

"This is a legacy project of tremendous importance to the survival of the citizens and the region for many generations into the future," said Bruce Hensley, general manager of the North Central Missouri Regional Water Commission.

have an increased cancer risk.

Protecting Our Rivers, Lakes and Streams

Missouri is home to 22,216 miles of permanent streams and rivers and 293,759 surface areas of classified lakes. Of this, 1,063 stream miles and 19,522 lake surface acres do not fully meet water quality standards. It is suspected that an additional 7,000 stream miles do not meet the standards.

Criteria and Classification

In Missouri, the Water Quality Standards define the goals for a water by designating its beneficial uses and defining the level of water quality necessary to meet each of these uses.

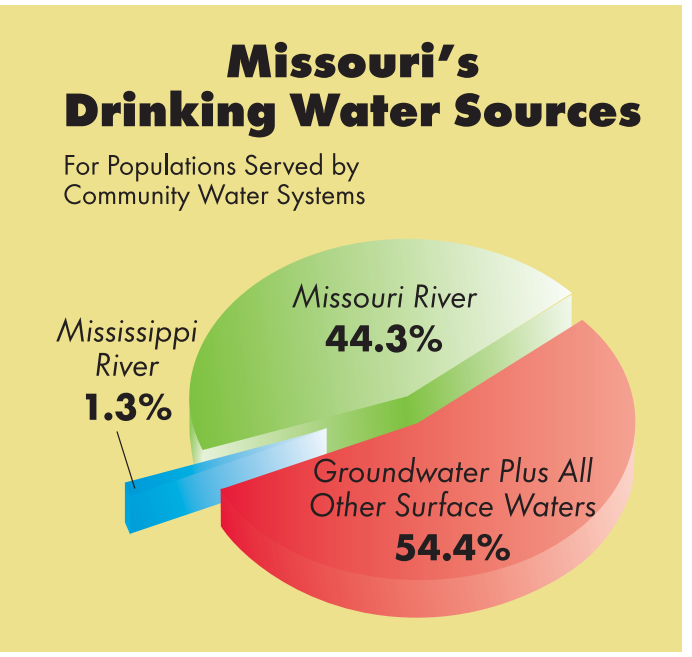
Beneficial uses include protections for swimming, aquatic life and human fish consumption, as well as other protections. The standards also set maximum levels for up to 100 or more contaminants for each beneficial water use.

In 2006, the Missouri Clean Water Commission adopted the Missouri Antidegradation Rule and Implementation Procedure. This procedure establishes a clear method for identifying the appropriate levels of protection for each water and for translating that decision to the selection of treatment technology to protect the quality of the water. In 2008, the commission incorporated the procedure into the Water Quality Standards.

The department is also in the process of developing several additions to the Water Quality Standards. One such addition is nutrient criteria for classified lakes and reservoirs. The nutrient criteria look at phosphorus and nitrogen and will protect the nutrient state of the lake, which will provide overall protection for the beneficial uses assigned to the lake or reservoir.

The Department of Natural Resources has also begun developing aquatic life uses that describe the aquatic communities present in Missouri's

This bottomland well near Columbia pumps water from the Missouri River aquifer.



small streams. These uses will be dependant on the level of the aquatic life found in a stream. Once the biologic communities are identified, the department can develop criteria to protect those communities. Over the next five years the department plans to evaluate all of the state's waters to ensure those streams that have permanent flow and fully support aquatic life uses are assigned criteria that will protect the use.

In 2005, the Clean Water Commission adopted a statewide standard for the level of dissolved oxygen in classified streams. The department is testing and monitoring various streams to determine if a regional approach or standard would be more representative of the actual levels of dissolved oxygen in a water.

Monitoring and Assessment of the Quality of Missouri's Waters

Monitoring data indicates which waters are healthy and which are not. The department, along with several partnering agencies, collects data on streams, rivers and lakes across the state. The Department of Natural Resources uses this data to determine if a water meets the goals as defined in the water quality standards.

Every two years, the department reviews all the water quality data to determine which waters meet the water quality standards.

In 2006, more than 60 percent of permanently flowing streams and more than 90 percent of classified lake acres met the water quality goals.

The number of miles of streams that are impaired or that fail to meet water quality standards because of wastewater discharges has generally held steady since 1984, when statewide data on stream quality first became available. In 1984, 105 miles of classified streams were judged to be impaired by domestic or industrial wastewater. The lowest estimate of this type of pollution was 42 miles in 1996. In 2006, point source pollution impaired approximately 90 miles of classified streams.

The effective management of water quality depends on sufficient information on pollution levels and sources. More sampling and analysis of Missouri's waters is needed. The state's monitoring primarily focuses on the most obvious pollution sources, such as areas of historic pollution including old mining areas and abandoned ore smelters, agricultural runoff including sediments, pesticides and nutrients, and major wastewater treatment discharges.

Additional water quality monitoring is needed to increase protection of smaller, unclassified streams that support aquatic life and recreational uses, address emerging issues such as the effects of pharmaceuticals and other complex chemicals, and identify and define trends in water quality where protection efforts are needed to avoid future water quality problems. The state would also benefit from additional monitoring to assess the effectiveness of the national criteria in protecting beneficial uses in Missouri, specifically on pathogens (bacteria), dissolved oxygen and on certain pesticides and metals.

Use of Volunteer Water Quality Data

The Volunteer Water Quality Monitoring Program is a partnership between the Department of Conservation, Department of Natural Resources, the Conservation Federation of Missouri and the citizens of Missouri. The program trains volunteers to monitor streams in their area. Information submitted by volunteers is entered into the volunteer monitoring database. Approximately once every two years, data is extracted from the volunteer data base and reviewed to determine if the

Reeds Spring Water Gets Extra Attention

As a teenager, how did you spend your free time? Earning a little extra cash at a part-time job? Wooing that cute lab partner in chemistry class? Tinkering with the woofers on your car's stereo? As teenagers, most of us lived day to day, focused on surviving that next exam or finding a date for prom. At Reeds Spring High School, however, students are showing that teenagers with a mind for science, a heart for the environment and an eye toward the future can create a safer, healthier community.

Photo by Eric Vance, EPA

Pictured left to right: Daniel Seiler, President George W. Bush, Ross Carter, First Lady Laura Bush, Tia Polidori and Julia Pope.

Since its formation in 1993, the Reeds Spring High School Stream Team 432 has helped educate the general public about environmental issues and how to get involved in local efforts. This Stream Team has established partnerships with universities, state agencies and local organizations to develop sustainable solutions to risks posed to local water quality. In addition to cleaning up local waterways, it has also served as a launching point for more than 60 former team members who have pursued careers in environmental protection.

In the spring of 2007, members of the Reeds Spring High School Stream Team researched and designed a project on water monitoring. The team collected and analyzed water samples at specific sites along a local stream after school and on weekends. After collecting water samples, students returned to the school's lab to test for eight indicators of stream health: fecal coliform, pH, dissolved oxygen, ammonia, nitrates, phosphates, living organisms and clarity. The data were analyzed and sent to the Missouri Department of Natural Resources to be included in a statewide water quality database. The team also floated the James River to pick up litter, sample stream invertebrates, test water acidity and collect water samples.

They prepared maps, graphs, and spreadsheets of data to illustrate the results of water testing. Stream Team members also gave presentations to school staff and organizations to inform the community about protecting its streams and how individuals can become involved in improving stream quality. Team members researched environmental regulations and the impact on stream quality and traveled to Jefferson City to discuss local water quality issues with the Missouri Legislature.

The students' main concern is erosion along local stream banks. They also find litter disheartening.

"Sometimes we think that people just don't care," said one student. "But we care and we are going to clean it up."

In recognition of these efforts, the Environmental Protection Agency recently awarded the Reeds Spring High School Stream Team the President's Environmental Youth Award. In a ceremony in Washington, D.C., President George Bush presented the award to students Brook Morey, Robin Langton, Molly Riddle, Ashleaha Farley, Julia Pope, Daniel Seiler, Ryan Lear, Ross Carter, April Van Haitsman and Mikal Farley, and teachers Mike Collins and Tonya Lewis.

Reeds Spring High School is the only entity to win the President's Youth Environmental Award twice. They also were an award recipient in 2002 for its state-of-the-art in-vessel composting and recycling program. The win had special meaning for Missouri Department of Natural Resources Director Doyle Childers, who taught at the high school for many years.

"At a time when many youth are losing their interest in nature and the outdoors, to see this group so enthusiastic about protecting stream quality is inspiring," Childers said.

The Stream Team Program is a cooperative effort between the Missouri Department of Natural Resources, the Missouri Department of Conservation and the Conservation Federation of Missouri, and includes approximately 3,600 stream teams statewide. For information about the Stream Team Program, visit www.dnr.mo.gov/env/wpp/VWQM.htm or www.mostreamteam.org.

data indicates water quality problems. Areas where volunteer data indicate potential water quality problems are targeted as high priority sites for follow-up monitoring by the department.

Restoring and Protecting Our Water Quality

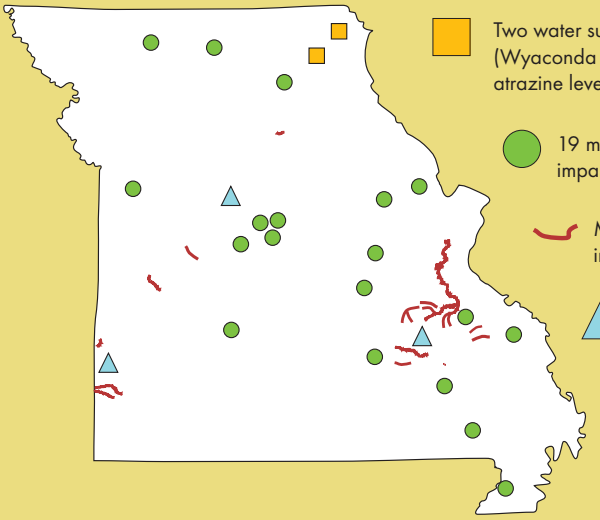
The department uses a variety of tools to reduce pollution and protect and improve water quality. Those tools include issuing permits, conducting studies to determine the pollutant levels in a watershed and promoting ways to reduce nonpoint source pollution.

With the development and implementation of nutrient criteria, it is important the department begin to develop limits for permits on a watershed basis which includes provisions for trading between point source discharges and trading between point source and nonpoint sources of nutrients. Permits developed on a watershed basis allow for a comprehensive reduction in pollutants which should result in substantial improvements in water qual-

ity. Challenges in implementing trading involve developing appropriate ratios between point source and nonpoint source pollutants and ensuring that once a trade occurs the nonpoint source reductions are actually implemented within an appropriate timeframe.

A Total Maximum Daily Load, also known as a TMDL, is a calculation of the maximum amount of a pollutant a water can absorb before its quality is affected. The TMDL process is a tool used to fight water pollution and is written to help restore waters listed on the 303(d) List. Its main objective is to restore and protect water quality in our streams, rivers and lakes. Missouri submitted nine TMDLs and Permit Limits in Lieu of TMDL to the U.S. Environmental Protection Agency for approval in 2007. In addition to the water segments with TMDLs or Permit Limits in Lieu of a TMDL, Missouri was successful in removing 14 waters from the 303(d) List where water quality standards are being attained or do not exist.

Missouri Water Quality Problems at a Glance



Two water supply intakes for public drinking water supplies (Wyaconda Lake and Lewistown Lake) have long-term atrazine levels that exceed state standards.

19 municipal wastewater treatment facilities that impair 1 mile or more of classified stream.

Mining impacts from coal, lead or zinc that impair 154 miles of stream.

Industrial discharges that impair more than 1 mile of stream. These include the Doe Run Co.'s Buick Resource Recycling facility, Empire District Electric Co.'s Asbury Power Plant and Tyson Food's Sedalia Processing Plant.

Information based on the 2004/2006 303(d) List, which was approved by the commission on April 20, 2007 and is pending EPA approval.

Jordan Creek urban stream revitalization project in Springfield.

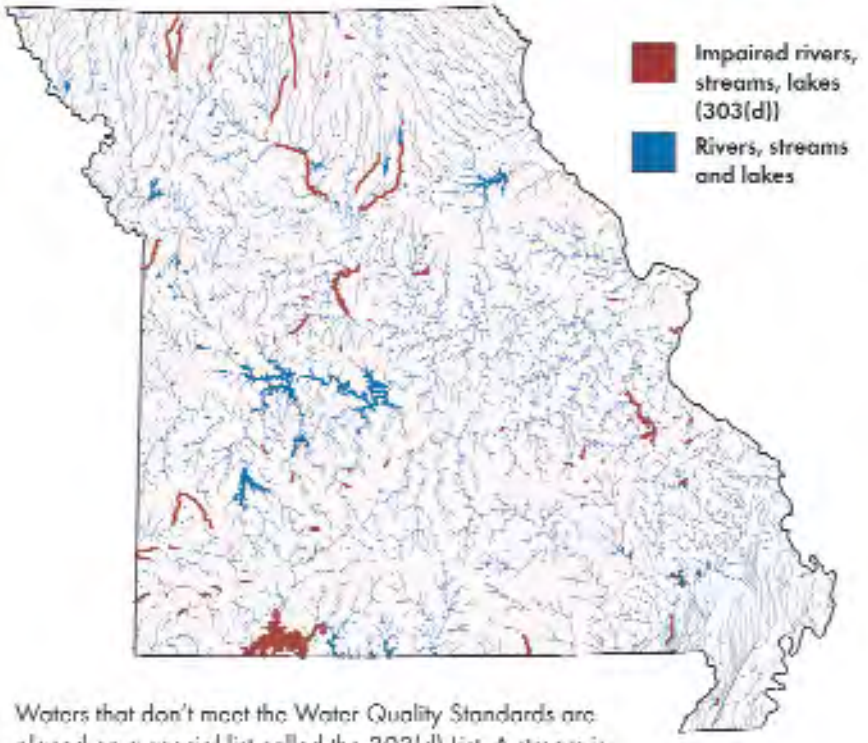
Nonpoint source pollution, a type of pollution that does not come from specific discharges, poses a serious threat to Missouri water quality. Runoff from agriculture, urban areas and abandoned mine lands are all examples of this type of pollution. This pollution affects almost half of Missouri's streams and rivers and about one-third of the lakes. The department has several grant programs aimed at the reduction of nonpoint source pollution.

Another source of pollution to our waters are combined sewer overflows and sanitary sewer overflows. The department is currently working to reduce these overflows to improve the water quality of the state's waters.

Combined sewer systems, or CSOs, are sewers that are designed to collect rainwater runoff, domestic sewage and industrial wastewater in the same pipe. Most of the time combined sewer systems transport all of the wastewater to a sewage treatment plant, where it is treated and then discarded to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater, including rainwater runoff, domestic sewage and industrial wastewater, directly to nearby streams, rivers or other waters. These are referred to as combined sewer overflows. These constructed overflows are almost always installed to prevent sewer surges in public areas and basement backups in homes.

Sanitary sewer overflows, also known as SSOs, specifically apply to sewers that carry only wastewater, but storm water infiltrates into the sewer from cracks in the sewer mains or enters from house drain connections. These systems do not carry storm water collected from street gutters, inlets or storm sewers. Types of SSOs include

Waters on Missouri's 303(d) List



Waters that don't meet the Water Quality Standards are placed on a special list called the 303(d) List. A stream is considered impaired when it fails to meet the Water Quality Standards set by the Clean Water Commission. Section 303(d) of the federal Clean Water Act requires states to identify and list all impaired waters. The list is revised and updated approximately every two years. The most recent list is the 2004/2006 303(d) list, which was approved by the commission on April 20, 2007 and is pending EPA approval.

constructed pipe overflows and discharges due to sewer main blockages.

The department is working with EPA to help communities address their SSOs. The department and EPA collaborated to develop a strategy for working with communities with SSOs to reduce the public health risk and bring the wastewater treatment systems into compliance with the federal Clean Water Act and Missouri Clean Water Law. Developing a strategy together helps ensure consistency and quicker resolution of the problem.

This strategy includes discussions with each community to develop a plan and timeline for correcting the deficiencies, while taking into consideration the financial challenges.

Financing Water and Wastewater Infrastructure

One of the biggest obstacles to clean rivers and streams and safe drinking water in Missouri is simply a lack of funding for maintaining and updating wastewater and drinking water treatment facilities. The strain placed on many communities' public infrastructure has continued to grow, while financial resources have shrunk in recent years.

Missouri estimates the infrastructure needs to ensure clean and safe water may be as high as $11.7 billion over the next 20 years. Unfortunately, the funding shortfall may be as much as $6.1 billion.

Since 1989, the State Revolving Fund has provided more than $2.1 billion to 240 Missouri communities to construct and improve wastewater treatment and drinking water facilities and infrastructure.

Towns and cities across the state have saved more than $573 million dollars in interest charges compared to conventional, higher interest rates of financing. In addition, projects financed by the fund resulted in the creation of more than 40,000 permanent jobs.

Water Quantity and Monitoring

Missouri is truly blessed with abundant water resources such as large rivers, streams, lakes and high-quality aquifers. However, the quantity of water may not always be adequate to meet demand during times of drought or when conflict arises between competing water uses. Missouri is working to improve its knowledge base of information regarding water supply, water use, and assessment of future needs.

As part of the state's budget for Fiscal Years 2007 and 2008, Gov. Blunt approved $1.6 million to enhance water resource assessment and monitoring statewide. A nearly completed expansion of the groundwater observation well monitoring network has broadened the capability to monitor groundwater levels statewide by nearly doubling the number of observation wells. The groundwater-level monitoring network is operated and maintained by the department's Water Resources Center and consists of 140 wells that monitor Missouri's diverse aquifers statewide. Real-time data collected by the network

A DNR employee installs a data transmission antenna at a well-monitoring site in central Missouri.

DNR photo by Jim Vandike

is served to the public online. The department plans to add 17 more wells in FY09, bringing the total number of monitoring wells to approximately 157. Ten wells have been drilled near major water users in southwest Missouri to document water use and illustrate groundwater-level decline in the area. In addition, there are currently several studies underway to measure the change in groundwater levels throughout the southwest part of Missouri.

Real-time, surface water flows will be measured for numerous rivers and creeks after the planned installation of nearly 40 new stream gauges throughout the state. The expansion added to the existing stream gauge network operated by the U.S. Geological Survey (USGS). Automated gauges measure the amount of water flowing in streams or stored in reservoirs. Uses for the data include measuring flow during periods of flood and drought, providing information needed to assess drinking water supplies, designing bridges, and information that is helpful for recreation and ecological stream management.

In addition, lake bathymetry studies (level-volume measurements) have been performed for approximately 35 lakes and reservoirs in Missouri and provide data to water suppliers for determining water volume available for use.

Gauges have been placed on tributaries or on the upper reaches of major rivers to better understand the variability of smaller streams. These smaller watersheds can be more severely impacted by both drought and flooding. During the spring and summer flooding of 2008, many of the new gauges were used by the National Weather Service to help predict flooding.

Some of the new gauges are located on streams and rivers that are also popular for recreational activities. Floaters, fishermen, and campers can view stream levels over the Internet and plan their trips according to the stream conditions they prefer.

To see if your favorite stream is currently gauged and what the flow conditions are, visit the Internet at: nwis.waterdata.usgs.gov/mo/nwis/rtnwis.waterdata.usgs.gov/mo/nwis/rt or call the department at 1-800-361-4827.

Bag irrigation on a cotton field in New Madrid County.

Water Use Reporting

Complete and accurate accounting of water use is a major step toward developing a meaningful assessment of Missouri's current and future water needs. Water use data is currently collected and analyzed by the Missouri Department of Natural Resources' Water Resources Center (WRC). State law requires any entity with the capability to pump 70 gallons per minute or greater (100,000 gallons per day) from any water source, to register with the department and report their water use annually. In FY06 there were 2,260 registered major water users in Missouri including 1,367 irrigators, 510 municipal users, 135 industrial facilities, 36 electrical generators and the remainder consisting of domestic and recreational users. While reporting has increased in recent years, compliance with the Major Water User Law has been low, averaging only 60 percent. Today there are nearly 2,800 registered major water users but the WRC estimates this accounts for only one-third of total major water users statewide.

Water use registration can be completed online, by e-mail, fax or U.S. mail. There is no fee for reporting. To report water use or obtain forms online, visit the Water Resources Center's Web site at: www.dnr.mo.gov/env/wrc/www.dnr.mo.gov/env/wrc/.

Flood

Precipitation in most of Missouri was well above average in 2008. North-central and southwest counties received near and above 200 percent of normal amounts of precipitation for January through July. Only the northwest corner of the state and Bootheel counties received near-normal total precipitation. Stream flow across the state responded to the high amounts of precipitation, flooding rivers in most parts of the state. Rivers with extensive flooding included the Mississippi, Missouri, Grand, Chariton, Platte, 102, Blackwater, Lamine, Marmaton, Meramec, Black and Jacks Fork rivers. Ponds and small lakes filled and large reservoirs in the state also reached very high levels. For example, Table Rock and Mark Twain lakes reached record high storage levels.

Missouri River

The Missouri River provides nearly half of the state's drinking water, while also providing cooling water to produce electricity, shipment of goods, recreation and tourism. The U.S. Army Corps of Engineers operates the six Missouri River Mainstem Reservoirs located in the Dakotas and Montana. While the reservoir levels are still down from the drought that began in 2000, they rebounded in 2008 because of near-normal mountain snowpack and low reservoir releases due to downstream flooding. On July 1, 2008 the entire reservoir system's drought pool was two-thirds full.

Depletion of water is a growing issue on the Missouri River. The U.S. Geological Survey estimated the

amount of water in the Missouri River has already been depleted by approximately 28 percent. The majority of the water is consumed by western states, located upstream of Missouri. The department continues to oppose additional depletions that would impact Missouri. One such project is North Dakota's Garrison Diversion, a massive water project that could divert approximately 1 million acre-feet of water per year from the Missouri basin.

In 2004, the Corps revised its Master Water Control Manual to retain more water in these reservoirs. Even though the revised Master Manual shifted a large amount of water to the reservoirs, upstream states continue to press for more water. A new challenge this year has been an initiative of Gov. Mike Rounds of South Dakota to decommission navigation as an authorized use on the Missouri River. Besides the obvious impact to navigation, water that supports navigation is key for our drinking water intakes and power plants.

In addition to South Dakota's efforts, North Dakota Sen. Byron Dorgan introduced language into next year's appropriations bill that would authorize $25 million for a study by the Corps to review the purposes of the 1944 Flood Control Act (FCA). The FCA established navigation and flood control as the dominant purposes of the Missouri River system and recent court decisions have reaffirmed the prioritization. This study would perpetuate the great uncertainty over future river management that has existed the past 20 years.

The U.S. Fish and Wildlife Service 2003 Biological Opinion mandated the Corps develop and adopt a Gavins Point spring rise. The Fish and Wildlife Service hypothesized that the spring rise was needed to cue the pallid sturgeon to spawn. In response to the Biological Opinion, the Corps revised the Master Manual again in 2006 to include criteria for the spring rise. Monitoring now indicates that pallid sturgeon are spawning without the spring rise.

The department was appointed by the governor to represent Missouri on the drafting team for the Missouri River Recovery Implementation Committee (MRRIC). Its duties include providing input to the Corps on the existing endangered species recovery plans for the pallid sturgeon, least tern, and piping plover. Missouri also will provide input on the existing Missouri River mitigation plan.

Representatives from the states,

The Missouri River provides an opportunity for a unique paddling experience.

CHALLENGES: Protecting Our Water

- Missouri's aging drinking water and wastewater infrastructure serving Missouri's cities and towns are in serious need of improvement or replacement. The cost to meet this need is estimated to be $11.7 billion over the next 20 years. This need will continue to increase as new standards are implemented to protect drinking water and our rivers, lakes and streams.
- Monitoring data indicates which waters are healthy and which are not and what changes are needed to restore impaired waters. Monitoring data also enables the department to draft permits based on actual stream conditions, not conservative assumptions. Therefore, permits are less costly to comply with yet are protective of water quality. The department must close significant gaps and increase its monitoring efforts to be successful in managing water quality. Closing the gap requires a stable funding source to support long-term monitoring strategies.
- Mercury pollution from power plants both here and abroad, medical and hazardous waste incineration, cement kilns and dental waste, continues to pose a particularly significant threat, making its way into Missouri's rivers and streams. Mercury is a local, regional and global problem.
- Nonpoint pollution affects almost half of Missouri's streams and rivers and approximately one-third of the lakes. Unlike point source pollution where the source of the pollution can be more readily determined, nonpoint pollution likely has multiple sources. Addressing nonpoint pollution will be a long-term challenge to determine the sources and identify solutions, which can take years to implement.
- Resolving the combined sewer overflow and sanitary sewer overflow issues will require a substantial financial investment by communities and will take many years to implement. The department and EPA will need to work closely with each community to address this challenge.

Energy Resources in Missouri

A daily-double urban challenge – rush hour.

The Missouri Department of Natural Resources has significant responsibilities in the energy arena. The strong relationship between energy use, environmental quality and economic vitality makes the topic of energy a relevant one for the department and for Missouri citizens. The kinds of energy sources we use affect the quality of our air and water. Thus, department staff work to advance energy efficiency and the use of cleaner renewable energy resources to diversify Missouri's energy mix beyond traditional and costly fossil energy resources.

Energy efficiency provides the most cost-effective way to address many of the challenges of growing energy demand, higher energy prices, energy security, energy reliability and environmental quality. The department's Missouri Energy Center manages projects and provides technical assistance to deliver energy-efficiency services and programs to Missourians, including energy-efficiency improvements to existing housing, improved energy-efficient building techniques and technologies for new homes, training for public- and private-sector facility managers, and industrial energy-efficiency opportunities. The department participates in utility regulatory cases to encourage utility investments in energy-efficiency programs for customers and helps utilities design these programs. In addition, the Energy Center monitors energy supplies and prices, conducts special assessments in response to potential or actual supply disruptions or shortages, and coordinates with state and federal agencies and decision-makers.

Department staff work to advance use of Missouri's coalbed methane resources and evaluate opportunities for hydroelectric and nuclear energy. Efforts toward cleaner, more energy-efficient technologies for coal-fired electrical generation plants are critical.

These efforts have helped to stimulate construction of wind-generation projects in the state, increase the use of ethanol and biodiesel and support interest in carbon sequestration projects. The department helps ensure that Missourians enjoy adequate energy supplies and works to avoid or minimize disruptions in energy supplies. These actions help secure energy supplies needed to support economic activity in the state. The department also works to increase the use of energy resources from within Missouri. This retains more energy dollars within Missouri's economy, rather than losing these dollars to other states or nations for the purchase of energy sources that come from outside Missouri borders.

Energy Use in Missouri

Since 2003, the price of energy has risen dramatically due to a variety of issues, especially crude oil, which often serves as the price benchmark for all energy commodities. Ongoing unrest in oil-rich producing regions and an exponential growth in global oil demand have pressured crude prices from the $30 range to an all-time record price of nearly $150 per barrel in 2008. Missouri's record average retail gaso-

For Missouri Community, Answer to Energy Dilemma is Blowing in the Wind

The winds of change are certainly blowing in the tiny town of Rock Port.

Rock Port resident Eric Chamberlain has been interested in wind energy for many years, so in 2005 Chamberlain borrowed wind-energy assessment equipment from the Missouri Department of Natural Resources' Energy Center to help determine the potential this renewable energy source held for northwest Missouri.

In 2006, officials with the Wind Capital Group asked Chamberlain to assist them in developing the Cow Branch Wind Farm in Atchison County. As the project progressed, with Chamberlain's encouragement, the wind energy development team agreed that the Cow Branch project could be expanded to include the addition of a four-turbine wind farm within the incorporated area of the city of Rock Port. John Deere Wind Energy, based in Johnston, Iowa, financed the project. John Deere Wind Energy is a unit of Deere & Company, the world's leading manufacturer of agricultural equipment.

Photo by W.C. Farmer

Rock Port's Loess Hills Wind Farm.

Rock Port city officials applied for a loan from the Missouri Department of Natural Resources' Energy Center to help pay for improvements to its substation. The improvements made the electrical system more energy efficient, which in turn helped Rock Port develop a new system that would make even better use of its wind power.

Finally, with the flip of a green switch on April 18, 2008, this city of 1,300 became the first city in the United States to produce more electricity from wind resources than it uses. Through the joint commitment among Rock Port city officials, landowners, John Deere Wind Energy and the St. Louis-based Wind Capital Group, the 5-megawatt Loess Hills Wind Farm now produces up to 16 million kilowatt hours of electricity annually.

The power is being purchased by the Missouri Public Utility Alliance, which is a pool of Missouri communities. The power pool will continue to provide Rock Port with electricity when the wind isn't blowing. On average, the four turbines will produce in excess of 100 percent of Rock Port's annual electricity needs, making it the first city in America capable of meeting its entire annual electricity demand from wind energy.

With the world searching for stable sources of energy that are also planet-friendly, all eyes are on this little town in northwest Missouri. The benefits of wind energy are numerous. It's much cleaner than many other sources of energy. It can be produced domestically, which makes it reliable and keeps dollars at home. The nation's wind supply is abundant.

For many rural communities, wind energy also holds the promise of providing an additional source of income. Wind turbines can be built on farms or ranches, thus benefiting the economy in rural areas, where most of the best wind sites are found. Because the wind turbines use only a fraction of the land, farmers and ranchers can continue to work the land, while also receiving rent payments from wind power plant owners.

Wind energy offers many advantages, which explains why it's the fastest-growing energy source in the world. Many are hopeful that the Rock Port project can serve as an inspiration for future projects.

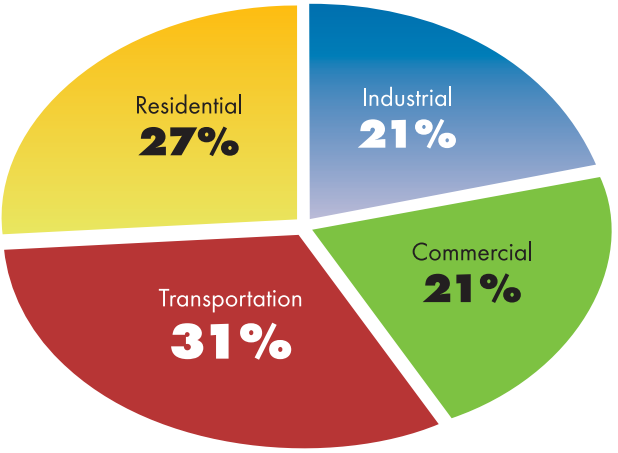
line price of $3.89 was set on July 7, 2008. This price was nearly $1 per gallon higher, while the average diesel fuel price was more than $1.50 per gallon (55 percent) higher for the comparable period in 2007. Energy outlook projections by the U.S. Department of Energy forecasted average retail gasoline and diesel prices to remain near these record levels through the end of 2009. Natural gas prices in the summer of 2008 ranged from 40 to 80 percent higher than the same period in 2007.

As the price of commodities including oil, natural gas, wheat, corn and soybeans have all increased significantly in the past year, the retail price for gasoline, food and the basic necessities of life have correspondingly increased, forcing individuals and families to examine, and in many cases, change the way they live. As motor gasoline buoyed to $4 per gallon, families began to curb the use of vehicles, driving fewer miles and purchasing fewer gallons of motor gasoline.

In effect, higher energy prices are providing new opportunities for alternative forms of energy and fostering greater interest and participation in energy efficiency. As the price for traditional forms of energy has increased in the past five years, so has the development of alternative energy resources including renewable energy such as wind, solar and biomass.

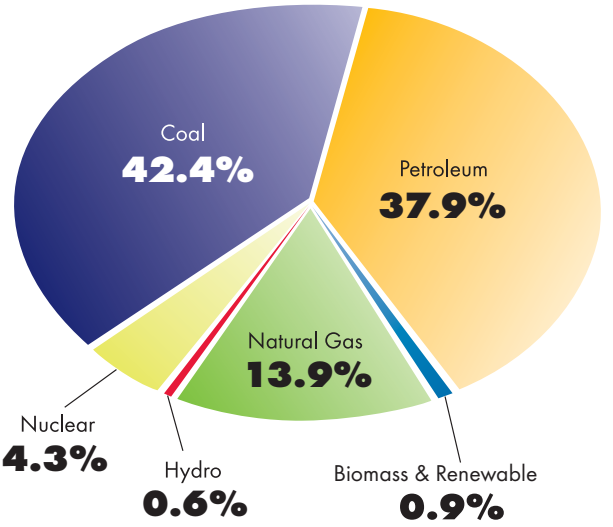
New wind generation systems are being constructed to supplement the generation and transmission of electricity from fossil-powered generators. Biomass in the form of ethanol is helping to replace a portion of the transportation fuel stream with new requirements imposed by Missouri and the U.S. Congress. In 2008, Missouri became one of just three states to require a 10 percent ethanol blend in its retail motor gasoline, which helps to reduce a portion of our dependency on gasoline supplied by other states and foreign nations. This has also helped

Missouri Energy Use by Sector



Source: U.S. Dept of Energy 2005

Sources of Missouri's Energy



Missouri's agricultural sector by providing an emerging market for corn, while the same phenomenon is occurring with soybeans as demand for biodiesel grows throughout the region.

The higher cost of transportation fuels, natural gas and propane has led to greater consumer demand for fuel-efficient vehicles and green vehicles, as well as the development of more efficient appliances, heating, ventilation and air conditioning systems, which consumers actively seek and purchase.

Fossil Fuel Resources in the State

All types of energy resources need to be evaluated in today's world.

Record oil and gas prices have contributed to increased interest in oil and gas potential in Missouri. Recent advances within the industry that can make it cheaper to recover unconventional oil and gas reserves may make Missouri a more significant energy producer. Through the third quarter of 2008, the number of applications received by the Missouri Department of Natural Resources' State Oil and Gas Council for oil and gas exploration doubled the previous year's total.

Since 2006, the number of applications received has quadrupled, and the numbers continue to grow.

Advancements in recovery techniques may be the key that enables companies to successfully tap into the oil in Vernon County, where the oil is very thick. Another unconventional source of petroleum reserves is oil shale, which when processed, yields hydrocarbons. The department received an application to drill a well in McDonald County in an effort to produce natural gas from this oil shale unit using experimental technology. The potential for coalbed methane production in Bates and Cass counties is also being explored in conjunction with the department and the Kansas Geological Survey. Preliminary results of this study are promising.

While interest in Missouri's oil and gas resources has significantly increased with higher energy prices, we must make sure we develop any energy resource in a safe and responsible manner.

Missouri's Renewable Energy Resources

Renewable energy comes in many forms. The potential to increase the use of solar, biomass and wind resources exists in Missouri and in surrounding states. Biomass is plant matter such as trees, grasses, agricultural crops or other biological material that can be converted to energy. It can include biogas from landfills and wastewater treatment plants, waste material including crop residue, wood waste and wood residues, animal waste and byproducts – such as fats, oils, greases and manure – and food and yard waste.

Missouri also benefits from hydroelectric power generated at several locations throughout the state.

Renewable energy holds another allure: the opportunity to help Missouri's economy grow. Every day, Missouri's farms have access to biomass, solar or wind resources that may be used for energy. New technologies offer the opportunity to harvest this energy for on-farm use, as well as for sustainable cash crops as these opportunities become cost effective. Finally, initiatives to develop renewable energy provide us with an opportunity to put products to good use that might otherwise have harmed our environment.

In the past five years there have been significant advances in efforts to harness the wind-energy potential of Missouri. The department's Energy Center initiated an updated assessment of Missouri's wind resources, the results of which have helped spur business decisions to locate utility-scale wind development in Missouri. In locations where wind developers have identified economically feasible sites for commercial-scale wind development, a number of factors have been present – strong winds, access to transmission lines, eligibility for federal tax credits, the economy of scale possible with large turbines and placing the generators on 80-meter towers to reach the higher speed winds found further above ground.

In 2007 and 2008, wind projects were constructed in Gentry, Atchison and Nodaway counties that now provide 150 megawatts of electricity for

Photo by Michael Koch

During an energy audit, Chatchai Pinthuprapa of the Industrial Assessment Center and a worker at the facility use an infrared camera to examine the operating conditions of the electric box connected to the die fabrication equipment.

Mizzou Tigers Tackle Energy Bills

Looking for a way to save your business money? It might be time to bring in the Tigers.

The University of Missouri provides free energy efficiency audits and recommendations to small- and medium-sized manufacturers through the university's Industrial Assessment Center (IAC). The center is run by a collaborative effort between MU's Industrial Engineering and the Mechanical and Aerospace Engineering departments. Established in September 2006, the Industrial Assessment Center is a part of a broader Department of Energy's Save Energy Now program. The DOE program has been in existence for more than 25 years.

The Missouri Department of Natural Resources' Energy Center collaborates with MU on this project, which both protects the environment and helps Missouri businesses save money. MU faculty, student employees and staff from the Energy Center provide the free energy-efficiency audits and offer recommendations to manufacturers throughout Missouri on ways to reduce their energy costs.

The center completed 15 Industrial Energy Audits statewide in its first year. The facility types have ranged from metal die casting to the manufacture of personal care products. At a food product machinery manufacturing facility, the audit team found that by relocating the air compressor intakes to a cooler location, the company could save $1,500 per year. The estimated cost to implement this recommendation was just $1,200, meaning the company could recover the costs of the improvement in only 10 months. At a heat exchanger manufacturing facility, the audit team found uninsulated steam and hot water lines. By properly insulating these lines, the facility has the potential to save more than $18,000 per year in energy costs.

Changes recommended in plant operations and energy efficiency improvements have demonstrated the potential to save each facility an average of about $90,000 per year, a possible total savings of more than $1.3 million in energy savings statewide. The potential savings to the environment are staggering as well. If all suggested recommendations were implemented in 2007 through 2008, the approximate savings in carbon dioxide emissions would be 8.35 million pounds.

To qualify for the free energy efficiency and productivity improvement assessments, small- to medium-sized manufacturers must have fewer than 500 employees, $100,000 to $2 million in annual total energy costs, less than $100 million in gross annual sales and lack in-house professional expertise in energy use and conservation.

Both the environmental and financial benefits of the IAC are multiplied by the effect that it has on the students involved, students who will take what they learn and apply it to their own businesses someday. The program includes a mix of undergraduate and graduate students. In just the first two years, 15 students participated.

"The students gain vital exposure to industries and their operations and how it affects the economy and the environment and society at large," said Sanjeev Khanna, an associate professor of mechanical and aerospace engineering at MU. "They also carry the message of the great need for energy conservation into the workforce and become centers for innovation in the area of energy."

For more information about these assessments, visit IAC's Web site at iac.missouri.edu/. Interested industries may also contact Roger Korenberg, Department of Natural Resources' Energy Center, 573-526-1723, or Sanjeev Khanna, assistant director of the Missouri IAC, at 573-884-9109.

Missouri citizens and businesses through the Associated Electric Cooperative system and for Columbia Water and Light customers. Rock Port, a city of 1,300 people in northwest Missouri, recently made history by being the first city in the U.S. to be 100 percent powered by the wind. As America's first wind-powered community, Rock Port hosted a "Green Switch" Celebration in April 2008. The 5-megawatt Loess Hills Wind Farm is connected to the city power grid and produces up to 16 million kilowatt hours of electricity each year.

Rock Port requires 13 million kilowatt hours for their annual energy needs, so they are actually exceeding their total demand entirely through the use of wind power.

Potential wind developers continue to explore the siting of additional wind farms in Missouri. The Energy Center partnered with Missouri utilities and the University of Missouri-Columbia to install wind-measuring equipment on tall communication towers to gather additional data about Missouri's wind resources. This information will further inform potential investors of utility-scale wind generation turbines. In 2008 the Energy Center also hosted a series of wind energy forums across the state using videoconferencing technology, to help inform Missourians on wind issues of interest and identify issues that need

(Top) Some "green buildings" employ exterior sunshades which can minimize summer heat gain and capture winter sun for passive heating.
(Inset) Missouri's summer solar radiation is comparable to Florida's, making solar energy a viable future choice for some power needs.
(Above) Modern insulation materials, such as recycled denim fibers, contain no fiberglass and can provide industrial-scale energy savings.

to be addressed to further develop Missouri's wind resource.

The solar energy resource in Missouri remains a largely untapped opportunity because of the comparative high cost of many solar installations when compared with other power options. Missouri has an average daily summer solar radiation comparable to the vast majority of the United States, including the state of Florida. One of the most important aspects of Missouri's solar resource is that it is most abundant when demand for electricity is highest – during the hot summer days when air conditioners place the greatest demand on the electric grid. As the cost of traditional fossil fuels increases and the cost of solar energy declines, solar energy for electrical power generation and water heating may become more cost-effective as a means to help meet peak electrical demand.

As a major producer of agricultural and forest commodities in the nation, Missouri has an abundant and diverse biomass resource, with significant potential for development into bioenergy, biofuels and biochemicals. Substantial land area exists in Missouri for energy crops and crop waste, ground cover on Conservation Reserve Program set-aside acres, timber-harvesting residues, primary wood-processing wastes, animal waste and municipal solid waste.

Missouri is a leading state in the effort to further the use of biofuels. For a number of years, Missouri has aided the development of ethanol and biodiesel with production incentives and tax credits. As a result, Missouri now produces 275 million gallons of ethanol each year. In January 2008, Missouri became the third state in the nation to implement a renewable fuels standard, establishing a 10 percent blend of ethanol in regular gasoline. During the 2008 legislative session, the General Assembly considered proposals to require diesel fuel sold in the state to contain five percent biodiesel.

The department works to encourage ethanol and biodiesel use in the general marketplace, increase the use of biofuels in state-owned vehicles, and provide technical assistance and analysis focused on the use of various biomass materials for energy. The department is committed to advancing the production of biofuels from feedstocks in addition to corn and soybeans, and is focusing more resources on this development.

Agriculture, businesses and industries in Missouri show significant interest in other bioenergy and biofuels opportunities. To help cooperatives and municipal electric companies assess biomass as an energy source, the Energy Center and partners have developed a computer model to assist with preliminary feasibility analyses. Both AmerenUE and Kansas City Power and

Light are investigating the feasibility of biopower for pilot programs. Smaller scale bioenergy projects are being planned or undertaken by Missouri agricultural producers and businesses, using potential energy sources such as poultry litter and residues and wastes from forest products. A commercial algae production facility is underway in Saline County, and small-scale projects to grow dedicated energy crops like Jatropha are being planned.

Energy Efficiency

Since nearly 95 percent of Missouri's primary energy sources are imported from outside the state at a cost of nearly $20 billion each year, energy efficiency benefits Missouri's economy by reducing the rate at which dollars leave the state for the purchase of fossil fuels. Energy efficiency provides the most cost-effective way to address many of the challenges of growing energy demand, higher energy prices, energy security and energy reliability. Energy efficiency does not rely on any fuel and is not subject to shortages of supply or increased prices for natural gas or other fuels. Energy efficiency also plays a vital role in environmental quality, reducing negative effects to Missouri's air and water by displacing the need for fossil fuel generation.

The Missouri Energy Center participates in Public Service Commission (PSC) regulatory proceedings, resource planning processes and collaborative groups with electric and natural gas utilities to secure funding for energy-efficiency programs. Through these efforts and partnerships with regulated as well as municipal electric utilities, cost-effective programs are offered to Missouri residential, commercial and industrial customers to help reduce energy use and utility bills.

The Energy Center also administers the department's Energy Loan Program. The program currently is helping Missouri school districts and local governments save more than $105 million in cumulative energy savings through energy-efficiency improvements to their buildings and other public facilities. The center has loaned more than $80 million statewide since 1988.

Another recent example of Missouri's successful work in energy efficiency is its achievement with the nationwide campaign, Change a Light, Change the World. In teamwork with the Midwest Energy Efficiency Alliance, Missouri utilities, U.S. EPA and U.S. Department of Energy, the department has helped propel Missouri public awareness of the benefits of compact fluorescent lighting since 2001, sponsoring annual campaigns to provide retail rebate incentives and promote public awareness of energy savings possible with CFLs. The Energy Center has provided grant funds for Missouri customer rebates and secured funding from regulated utilities through agreements in regulatory case interventions before the state's Public Service Commission.

In 2007 and 2008, the Energy Center was joined by eight Missouri utilities and 58 retailers to help Missouri customers save money and energy with a twist of an ENERGY STAR® qualified CFL. Total energy savings to Missouri citizens from more than 88,000 CFLs sold through the Change a Light, Change the World program since 2001 are estimated at more than 34 million kilowatt hours.

A uniquely modern measure of Missouri citizens' enthusiastic adoption of energy-efficient lighting is Missouri's No. 4 national ranking in CFL sales per capita as reported by 18seconds.org, a Web site that tracks and reports nationwide CFL sales, since January 2007. In 2008, the site ranked Joplin, Springfield and Columbia metropolitan areas first, second and fourth in the nation among areas tracked.

High voltage power lines deliver electricity across the state from hydro-, nuclear- and coal-powered plants.

Energy Policy – Renewable Energy and Investments

Many states have adopted policies to encourage the use of renewable energy and investments in energy efficiency to achieve the resulting environmental, economic and security benefits to the general public. Missouri has also made advances in this area, including passage of the following legislation:

SB 54 (2007) – set renewable energy goals for utilities, and provided for net metering and interconnection by customers generating electricity with private renewable energy projects.

SB 931 (2008) – created a new tax credit for the installation of alternative fuel infrastructure.

SB 720 (2008) – dedicates a portion of state funds appropriated to the Utilicare fund to the department's Low-Income Weatherization Program. From 1977 through 2008, the Low-Income Weatherization Program has weatherized 154,228 homes and has reduced energy costs by over $12 million annually for Missouri's low-income, elderly and disabled citizens. Lasting energy efficient improvements are installed in the home, resulting in lower utility bills year after year.

SB1181 (2008) – established an annual sales tax holiday for purchase of energy-efficient appliances and a tax deduction for residential energy audits and energy-efficiency measures.

Our Air

A summer storm builds in rural Macon County.

Protecting and enhancing air quality is a challenging responsibility that requires participation from state and local governments, regulated entities and the general public. Urbanization, industrial development and the increasing use of motor vehicles has prompted the federal government to tighten air quality standards to levels that are more protective of public health and the environment. We judge air quality using the National Ambient (outdoor) Air Quality Standards established by the U.S. Environmental Protection Agency under the federal Clean Air Act. Ozone, fine particles and lead have been the primary pollutants of concern in Missouri. In addition, the state continues to follow nationwide developments on greenhouse gas and mercury emission reductions as these two pollutants require a national strategy for control.

Ground-Level Ozone

Naturally occurring ozone in the upper atmosphere protects the earth from the sun's harmful rays. Ground-level ozone is an irritant that damages lung tissue, aggravates heart and respiratory disease and can even cause problems for healthy individuals who spend a lot of time outdoors. It is also harmful to plants and trees. This pollutant is the most harmful part of what we sometimes call "smog."

Ozone is not directly emitted. It forms on hot, stagnant summer days as sunlight causes a reaction between nitrogen oxides and volatile organic compounds. Vehicles, power plants and industrial boilers are common sources of nitrogen oxides. Gasoline-powered vehicles and manufacturing are major sources of volatile organic compounds that can create ground-level ozone.

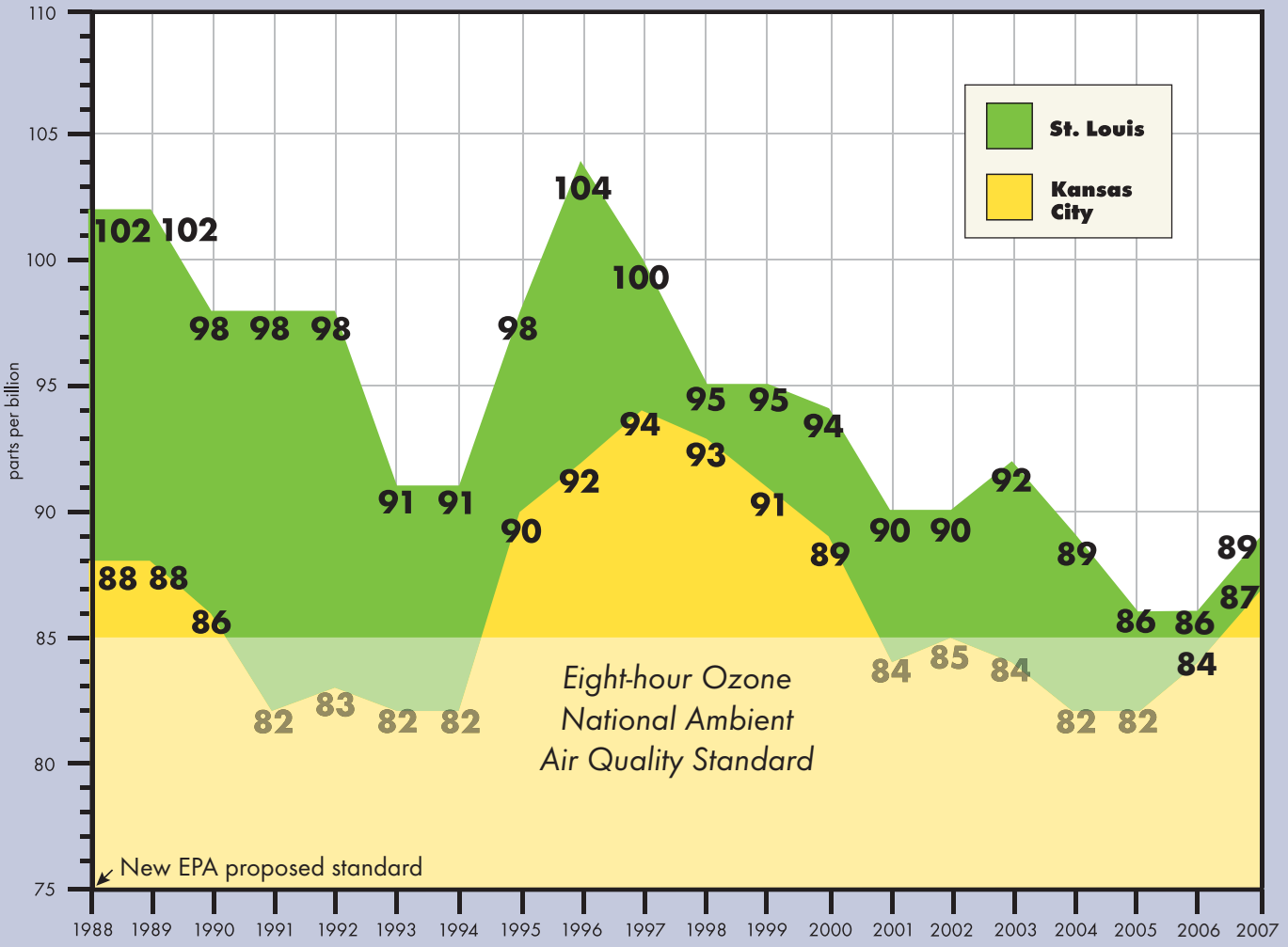
The U.S. Environmental Protection Agency recently reviewed the National Ambient Air Quality Standards for Ozone and proposed to strengthen them to a more protective level. The new ozone standard is an eight-hour average concentration of 75 parts per billion. All states must evaluate areas for compliance with the new ozone standard and designate areas that do not meet it as "nonattainment." Missouri has started that process, has met with a number of communities and municipalities and is evaluating its monitoring network.

The outcome of the evaluation process will be a list of counties in the state that currently monitor or are contributing to eight-hour ozone violations. The evaluation of counties under the new ozone standard must be completed by March 2009, at which time the state will forward its recommendation to EPA on which counties should be designated nonattainment. The EPA will make the final determination of the nonattainment area boundaries.

After EPA makes their final designations, the state will begin to develop plans outlining how Missouri will reduce pollution to meet the standard in each designated nonattainment area. These plans must be submitted to EPA for approval three years after final designations. The severity of the air quality in each area will dictate the date the area must meet the new standard, or face stricter controls on emissions.

Current air pollution control efforts in Springfield and state plans for St. Louis and Kansas City will remain in place as the state evaluates what additional options may be necessary to reduce the harmful emissions that contribute to the formation of ground-level ozone. Missouri citizens can also take

Eight-hour Ozone Values



The plotted values represent an average of three consecutive years of ozone monitoring data for air quality monitors in St. Louis and Kansas City. The air quality monitor with the highest averaged value sets the ozone value for the entire area. If that value exceeds 85 parts per billion, a violation of the eight-hour ozone standard occurs. The area ozone values are plotted on the last year of the three-year period.

The U.S. Environmental Protection Agency recently reviewed the National Ambient Air Quality Standards for Ozone and proposed to strengthen them to a more protective level. The new proposed ozone standard is an eight-hour average concentration of 75 parts per billion. All states must now evaluate areas for compliance with the proposed ozone standard. Based on current ozone monitoring data, all but one monitor in the state is violating this potentially revised standard. For more information, see Ground-Level Ozone entry on page 23 of this section.

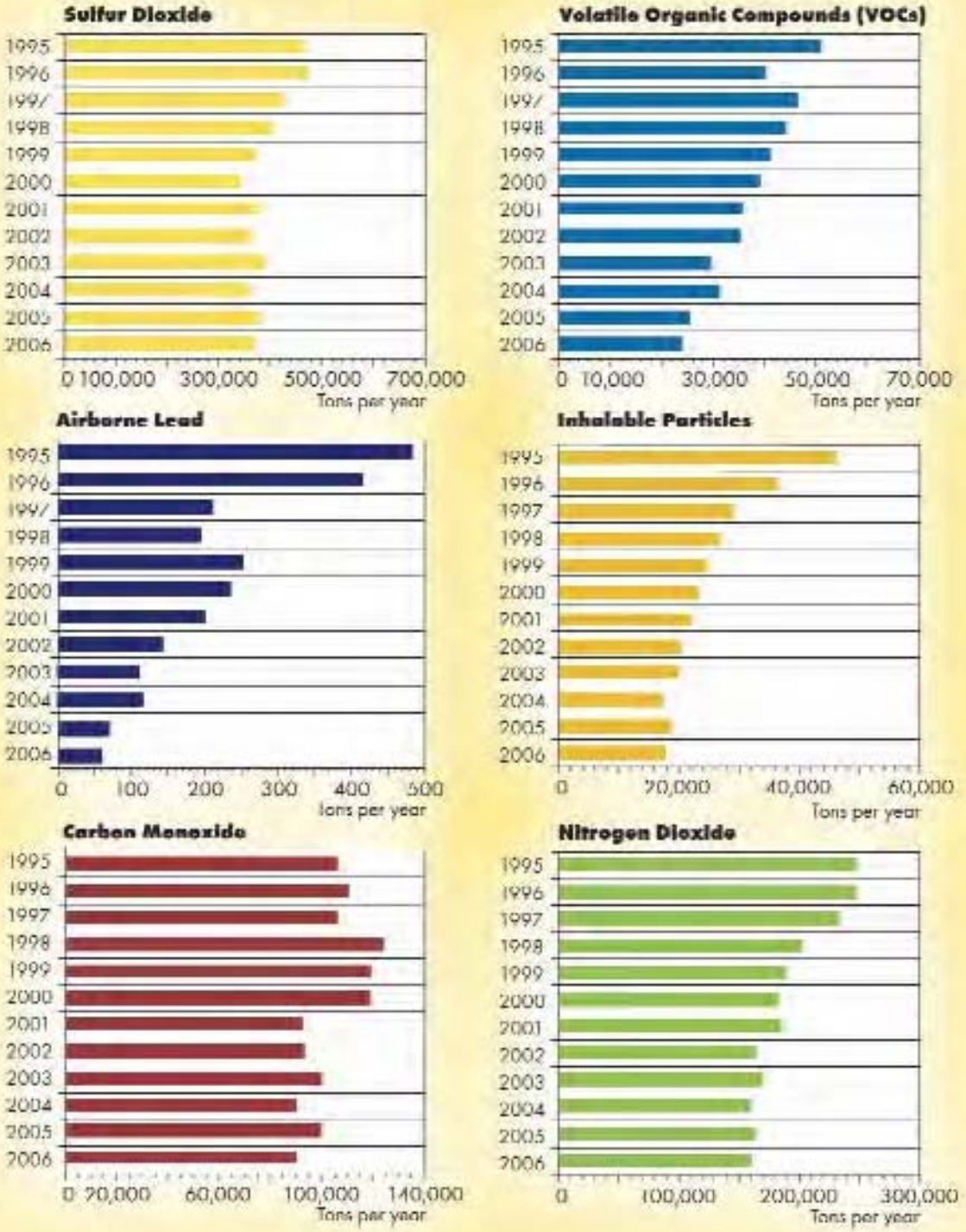
voluntary actions to reduce their impact on the state's air resources. Simple, everyday steps can be taken to protect air quality, and are available on the Web at www.cleanair-stlouis.com.

Vehicle Inspection and Maintenance Update

On Oct. 1, 2007, the department successfully transitioned to the Gateway Vehicle Inspection Program, or GVIP. The program, required by state statute 643.303 RSMo, is a decentralized On-Board Diagnostic-only vehicle emissions program. The GVIP requirements apply to vehicles registered in St. Louis City, and Franklin, Jefferson, St. Charles and St. Louis counties. The GVIP tests 1996 and newer vehicles with the OBD test to ensure vehicles are operating as cleanly as possible. Pre-venting the release of harmful vehicle emissions further helps to protect air quality for the region.

More than 700 independently owned businesses in the St. Louis ozone nonattainment area have been licensed to conduct the OBD emissions testing in addition to the statewide vehicle safety inspection on a biennial basis. As of May 2008, more than 400,000 vehicles in the St. Louis area have received an OBD emissions test.

Air Emissions



Sulfur Dioxide - Sulfur oxides are produced by burning sulfur-containing fuels such as coal and oil, by smelting metals and by other industrial processes. Sulfur dioxide (SO_2) makes up about 95 percent of these gases.

Airborne Lead - In Missouri, airborne lead and its compounds are produced mainly by lead smelters.

Carbon Monoxide - Carbon Monoxide (CO) is a colorless, odorless, poisonous gas that forms when carbon in fuels is not burned completely. It is a byproduct of vehicle exhaust.

Volatile Organic Compounds (VOCs) - Volatile organic compounds react with nitrogen dioxide (NO_2) on hot, summer days to form ground level ozone. Vehicles, power plants and industrial boilers are common sources of nitrogen oxides. Gasoline-powered vehicles are a major source of VOCs.

Inhalable Particles - Inhalable particles include airborne dust, pollen, soot and aerosol sprays. Scientists sometimes refer to these as particulate matter.

Nitrogen Dioxide - Almost all nitrogen dioxide is man-made. If fuel is burned above 1,200 degrees Fahrenheit, airborne nitrogen forms highly reactive nitrogen oxides such as nitrogen dioxide. Principal sources are power plants, industrial boilers and vehicles.

A Gateway Vehicle Inspection Program site at Dobbs Tire and Auto Center in Chesterfield.

Test results are transmitted to the Department of Revenue on a real time basis via a secure Web site, thereby allowing paperless verification of inspection results at all license offices and for all online registrations. The paperless verification process provides more convenience to St. Louis area motorists and helps to reduce operation costs for the state. The GVIP is a key component in the ongoing effort to improve air quality in the St. Louis region. For more information visit the department's Web site: www.GatewayVIP.com.

Process Improvements

Missouri recently revised the emissions reporting and fee rule to reduce the reporting burden on industry and provide department staff with more time to quality assure emissions data. This process improvement serves to assist not only our customers but allows more time for department staff to provide guidance and compliance assistance to sources who must report their air emissions. These changes became effective in January 2008.

Under the new reduced reporting requirements, facilities with a Basic Operating Permit will report full Emissions Inventory Questionnaires every three years instead of annually, and those with no operating permit will submit full EIQs every six years instead of every five. These changes will result in an estimated annual savings of nearly $800,000 for the 2,200 facilities impacted statewide. Facilities with a Part 70 or Intermediate operating permit will continue to report full EIQs on an annual basis. All facilities, regardless of permit types, must pay emission fees annually. The emissions fee per ton was also increased to $40. The next reporting year, 2008, all sources will be required to submit a full EIQ to conform to a three or six-year-cycle, depending on the permit type of the source.

Further efforts to provide compliance assistance to our customers have led to the development of wallet-sized asbestos certification cards. Department staff began distributing these conveniently-sized cards in late 2007. These cards reduce the burden on asbestos workers as they are easier to carry and allow department staff to identify certified workers onsite, thus ensuring appropriate efforts are made to protect air quality and public health on all asbestos-related projects.

In addition, the St. Louis Air Quality Management Plan is another example of how the department is working to streamline efforts to protect air quality. The Air Quality Management Plan is a pilot project that will collectively look at air pollutants to identify control strategies that will be the most cost-effective for the St. Louis area. This effort should provide maximum air quality benefits for all evaluated pollutants because the department will be more efficient in the process used to evaluate appropriate controls. This plan will also provide more certainty for the regulated industry as they work to control pollutants in a broader approach. Interested stakeholders will also benefit because there will be multiple opportunities to provide input on air quality management decisions throughout the plan development.

Continued Lead Monitoring in Missouri

In Missouri, airborne lead and its compounds come primarily from lead smelters. Airborne lead poses the greatest danger to children age six and under. The EPA recently strengthened the federal health-based standard for airborne lead from 1.5 to 0.15 micrograms per cubic meter. These revisions are expected to improve air quality and public health for

at-risk groups, especially children.

Lead emitted into the air can be inhaled or, after it settles out of the air, can be ingested. Ingestion is the main route of human exposure. Once in the body, lead is rapidly absorbed into the bloodstream and can affect many organ systems. Low doses of lead can damage the central nervous system of children and fetuses leading to seizures, mental retardation and behavioral disorders. In children and adults, increased blood-lead levels also cause fatigue, disturbed sleep, decreased fitness and damage to kidneys and blood-forming organs. Current health effect evidence does not indicate any safe level of lead exposure.

The EPA ruling is of particular significance to Missouri because one of only two nonattainment areas in the U.S. for the lead air standard is in Herculaneum, Mo. Herculaneum is also the home of the only operating primary lead smelter in the country and a designated Superfund site.

The department will begin examining all geographic areas in the state and make recommendations to EPA for areas that should be designated as attainment, nonattainment or unclassifiable. These recommendations are due to EPA next fall. EPA will issue final designations no later than October 2011. The department will submit State Implementation Plans or SIPs to EPA in early 2013. SIPs are designed to bring nonattainment areas of the state into compliance with the lowered standard. Based on current emissions data for the state, other types of facilities may see issues with a lowered standard in addition to the lead smelter in Herculaneum. These sites may include mines, cement plants, power plants, crushing facilities and potentially airports.

EPA's new rule also includes provisions to improve the existing lead monitoring network by requiring monitors to be placed near large sources of lead emissions and in urban areas with more than 1 million people. There are currently 19 lead monitoring sites in Missouri at four different locations. The Department of Natural Resources will determine where additional monitors are needed in the state to meet the new monitoring requirements.

Regional Control Efforts for Air Pollutants

In response to the federal Regional Haze Rule published in 1999, Missouri drafted a regional haze plan to improve visibility in two federal Class I areas in the state. Class I areas include federal protected national parks and wilderness areas. The federal rule and the Clean Air Act require consultation between states, tribes and Federal Land Managers for managing Class I areas since regional haze is often the result of air pollution emitted across broad regions and haze precursors can be transported great distances.

Missouri and Arkansas worked together to develop a consultation plan which was initiated in early 2007. A Central Regional Air Planning Association technical support document along with department analyses and modeling was used to develop the Missouri Regional Haze Plan. The plan was adopted by the Missouri Air Conservation Commission and submitted to the U.S. EPA early in 2008. The consultation process continues with other states as they develop their regional haze plans and will keep going as evaluations and progress reports are performed through 2064. At each five-year progress report, states will compare their current visibility conditions to baseline conditions and decide if

additional controls are needed.

Greenhouse Gas Awareness and Reductions

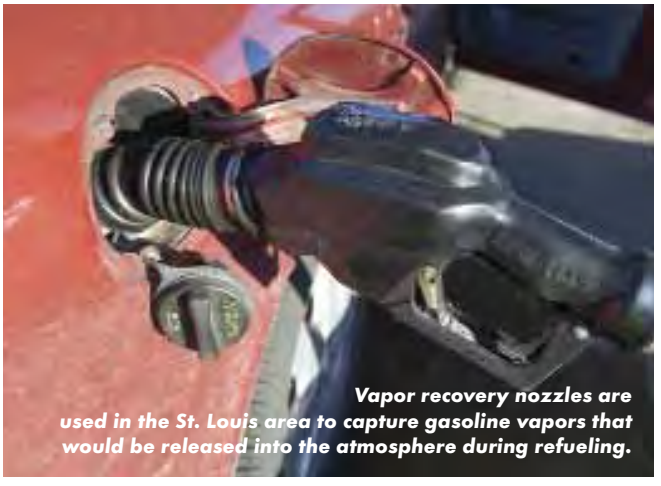
Concerns over climate change have made greenhouse gases a more prominent air pollution issue. Combustion processes such as burning coal, diesel fuel, gasoline, natural gas, wood and waste materials have increased emissions of greenhouse gases, such as carbon dioxide. The two largest sources of greenhouse gas emissions are coal combustion at power plants and petroleum combustion by motor vehicles.

Missouri joined with 31 states, one tribe and several provinces as a founding member of The Climate Registry, marking the largest multi-state effort to track greenhouse gas emissions. The Climate Registry will assist states and tribes in measuring, tracking and managing emissions of greenhouse gases. The registry will provide the measurement and reporting infrastructure to support a wide range of state and regional programs as well as any climate change program that may come about at the federal level.

Participating states and tribes will be provided with third-party verified, highly accurate emissions information that is consistent across borders and industry sectors. The registry will support both voluntary and mandatory greenhouse gas emissions reporting programs. Some states also plan to use information from The Climate Registry to support market-based programs and emissions reductions programs.

Missouri is also a member of the Blue Skyways Collaborative, which is helping to identify pollution control options in the central United States. Blue Skyways is a voluntary public-private partnership aimed at reducing greenhouse gas and air pollution emissions through implementation of projects that use innovations in diesel engines, alternative fuels, and renewable energy technologies. Implementation of these projects and others like them will reduce fossil fuel emissions use and reduce harmful emissions.

New, stricter air quality standards for ozone, proposed by EPA, could present yet another challenge for St. Louis and Kansas City.



Vapor recovery nozzles are used in the St. Louis area to capture gasoline vapors that would be released into the atmosphere during refueling.

Carbon Sequestration

National issues relating to climate change have created increased interest in cleaner-burning coal technology and reduction of carbon dioxide emissions.

Missourians, like all Americans, face the challenge of reducing emissions from coal-burning power plants in a safe, effective and economical manner. The federal government is considering imposing a limit on carbon emissions from power plants and may enact regulations that will require the capture and reduction of carbon emissions from coal-burning power plants in the U.S.

The Missouri Department of Natural Resources' Division of Geology and Land Survey, is a partner in two projects committed to developing an understanding of the possibility for geologic sequestration of carbon in Missouri. The purpose and goal of these projects is to evaluate different geologic settings for injectivity, containment, and storage effectiveness needed to determine the viability and potential for long-term

carbon dioxide storage in Missouri.

Geologists with the division will be working with researchers from the University of North Dakota to develop geologic data and determine strategies for the geologic sequestration of carbon in Missouri. This work is being conducted in support of carbon dioxide sequestration initiatives of the U.S. Department of Energy's Plains CO_2 Reduction Partnership (PCOR).

The division is also partnering with Missouri State University and the Missouri University of Science and Technology in a pilot project proposed by City Utilities of Springfield that will determine the possibility for carbon capture and storage at City Utilities' Southwest Power Station.

Missouri can realize significant economic and environmental benefits if carbon dioxide from coal-burning power plants in our state can be safely sequestered in geologic formations, potentially saving millions of dollars for the customers of electric utilities while reducing carbon dioxide emissions. Potentially, this will be a positive step toward reducing greenhouse gas emissions, as well.

According to the EPA, AmerenUE's Labadie low-sulfur coal plant is consistently one of the lowest emitters of nitrogen oxide in the U.S.

CHALLENGES: Protecting Our Air

- Missouri is seeing an increase in the building of ethanol and biodiesel plants as the demand for alternative fuels increases. The department is working with the ethanol and biodiesel industry to issue permits to these new facilities as quickly as possible while ensuring compliance with federal and state air quality standards.
- The department continues to monitor ambient lead levels around the Doe Run-Herculaneum lead smelter. The department revised the state's current plan to ensure this area achieves attainment of the current lead standard, but recent revisions to the national lead standard will require the state to re-evaluate Herculaneum and look at other areas that may fall short of meeting the tightened standard.
- In Missouri, major metropolitan areas like Kansas City, Springfield and St. Louis face the greatest threat from ground-level ozone. Recent revisions to the National Ambient Air Quality Standards for Ozone have prompted the state to reevaluate areas for compliance with the new ozone standard. The timeline to complete this evaluation is rigorous as the state must finalize and submit it to EPA by March 2009.
- Reports of objectionable odors are one of the most frequent complaints the department receives from concerned citizens. Odor is often very difficult to address because it can be difficult to determine its source and may be intermittent in nature. The department continues to work with the Missouri Air Conservation Commission and interested stakeholders on possible solutions to odor problems in the state. It is a challenge to find a solution that will protect quality of life for all Missouri citizens while allowing industries that bring business to the state to thrive.
- EPA recently published new federal regulations concerning gasoline dispensing facilities. The department faces the difficulty of identifying each affected source across the state to ensure their compliance with these new standards.
- New EPA monitoring proposals for ozone and lead related to the revised National Ambient Air Quality Standards for those pollutants will require the department to implement additional monitoring sites in a short time frame. Four new ozone monitoring sites will need to be installed and operating by April 2009. An additional eight lead monitoring sites may need to be added by January 2010. The need to conduct analysis to determine site locations, acquire lease agreements for the properties, purchase equipment and install sites will require considerable effort from the department.
- The department is continually challenged by the need for additional staff, funding and resources to meet the needs of increasing requirements for protecting Missouri's air quality.

Our Land

A view north from Osage County, across the Missouri River into southern Callaway County.

Our land sustains us by producing the fruits, vegetables and grains necessary to nourish our bodies and the timber that provides us shelter. The crops our land produces also are an important source of income for many in Missouri's rural communities. Minerals and rocks contribute to the economy of the state in a variety of ways. Some of these raw materials are key components in construction of roads, bridges, buildings, homes and numerous other products. Mining is the second largest economic income for the state next to agriculture. Limestone products are used in agricultural applications, pharmaceutical products, paper manufacturing, paint, glass making, cement and pollution control technologies.

Damaging our land by soil loss, polluting our soil or improperly disposing of solid and hazardous waste can have far-reaching consequences.

Soil Erosion

About 57 million tons of soil erodes from Missouri's agricultural land put into row crop production each year. Much of that soil enters our waterways, clogging and filling streams, reservoirs and lakes. The severity of flooding is increased as these silt-laden waterways and reservoirs do not have the capacity to hold as much water. Thinner topsoil also decreases soil productivity. Less production means lost income to the landowner and higher prices for the consumer. Although soil erosion is a natural event, certain traditional farm tilling methods can accelerate erosion. This depletes the soil, requiring more use of fertilizers and pesticides and sometimes even rendering it useless. Recently, large numbers of acres are being returned to crop production with the increase in commodity prices due to ethanol production. Many acres currently enrolled in the federal Conservation Reserve Program are now being cultivated for row crops, accelerating the loss of soil on highly erodible fields. These fields need to be protected with conservation practices to reduce the erosion potential.

The plan of the Soil and Water Districts Commission is to make practices and funding available to address districts' needs by specifically identifying resource concerns within each district. Districts will begin this needs assessment this year.

Because of its climate topography and soil types, Missouri will continue to address significant erosion problems on acres dedicated to cultivated croplands. Since 1982, Missouri has reduced its rate of soil erosion more than any other state. With funding from the parks, soils and water sales tax, the department's Soil and Water Conservation Program has provided approximately $463 million in financial incentives through 177,000 claims to landowners for voluntary soil conservation efforts.

Solid Waste

Improper disposal of solid waste can cause health and environmental problems such as groundwater and surface water pollution, air pollution and transmission of disease. To prevent these problems, today's permitted disposal facilities must meet stringent design, operation and maintenance requirements. Unfortunately, not everyone uses a permitted, engineered facility. Illegal dumping and other violations of the

Solid Waste Law sometimes make the enforcement arm of the Missouri Department of Natural Resources a necessary tool.

By reducing, reusing, recycling or composting waste, we can save energy, raw materials and landfill space. These activities can also reduce greenhouse gas emissions. The department provides Solid Waste Management Districts grants to promote waste reduction, recycling and proper waste management. More than $75 million has been used to divert more than 1 million tons of material from landfills since the grant program started in 1993. The department also provided grants through the Waste Reduction and Recycling Project program until a legislative change in 2005 removed the funding for the program. During fiscal years 1993 to 2005, the department awarded more than $22 million diverting almost 400,000 tons from Missouri's landfills.

Since 1993, the Environmental Improvement and Energy Resources Authority awarded 290 grants totaling more than $8 million for market development and technical assistance projects in the state.

Solid waste disposal alternatives resulted in a 46 percent diversion of trash (by weight) from landfills in 2007. Missouri companies use solid waste resources, otherwise destined for landfills, to create a variety of recycled products.

Missouri has 21 active sanitary landfills accepting municipal solid waste, six utility waste landfills accepting ash from coal-burning power plants, three construction and demolition waste landfills, three special waste landfills and 55 transfer stations. Transfer stations consolidate trash before moving it to a regional landfill. A good portion of Missouri's waste still ends up in landfills. Per capita, each Missourian generates more than 1 ton of waste per year.

The siting of solid waste facilities such as landfills and transfer stations has become increasingly difficult and controversial. Everyone generates trash but few want a landfill or transfer station nearby. As a result, some communities have passed local zoning ordinances prohibiting the siting of these facilities within their borders. Transporting waste long distances due to lack of nearby disposal facilities increases disposal costs for citizens. However, a well-designed, properly operated facility can successfully exist in a community without creating problems, as evidenced by numerous existing facilities in the state.

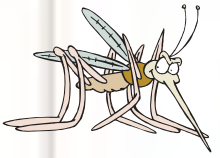
Cleaning up Scrap Tires

When scrap tires are not disposed of or recycled properly they pose serious threats to human health and the environment. Tire fires can burn for months and release hazardous substances into the air and possibly into surface and groundwater sources.

Since 1990, more than 15 million tires from 779 illegal dumpsites have been cleaned up in Missouri. The department estimates there remain at least 300,000 scrap tires in known dumpsites, and potentially another 500,000 tires yet to be discovered. The remaining dumpsites are smaller in size, harder to find and are often located in hard to reach areas. These characteristics have slowed the cleanup of scrap tire dumpsites and increased the cleanup costs.

In November 2006, the department initiated the Tire Dump Roundup Program to assist in locating and expediting the cleanup of these remaining smaller dumpsites. The program provides an incentive to citizens to self report scrap tire dumps on their property by allowing for a free cleanup of the scrap tires if the program's criteria are met. The basic program criteria require the sites to contain between 500 to 10,000 tires, the property owner must not be an operating tire generating business, and the property owner must sign an access agreement where they agree

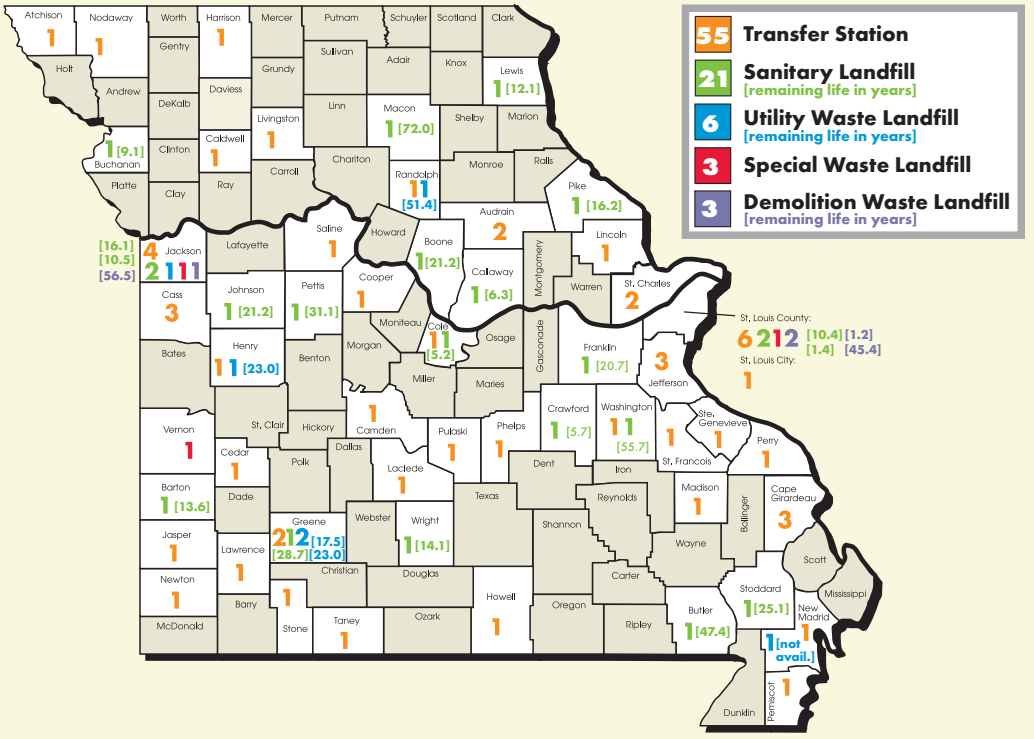
Cases of West Nile Virus Reported in Missouri



2007 - **77**
2006 - **62**
2005 - **30**
2004 - **36**

Source: Centers for Disease Control and Prevention

Missouri Landfills and Transfer Stations



to maintain compliance with environmental regulations for two years from the execution of the access agreement. The program has been well received and has revealed more than 170 dumpsites with an estimated 367,000 tires.

The department works with Missouri's 20 Solid Waste Management Districts to facilitate cleanups by nonprofit groups and creating staging areas for dumpsites with less than 500 tires.

Landfill gas monitoring at a St. Louis-area site.

Water standing in scrap tires provides an ideal breeding ground for mosquitoes, which are known to carry diseases such as the West Nile virus. In 2006 and 2007, there were 139 reported cases of West Nile virus in Missouri. This number has increased from the 66 cases reported in 2004 and 2005.

Tire cleanups are funded by the Scrap Tire Fee, in which vehicle owners pay 50 cents for any new tire purchased in Missouri. The fee generates about $2.1 million annually and helps the department oversee and support scrap tire cleanup efforts. The fee expired on Jan.1, 2004, and was reinstated with the passage of Senate Bill 225 during the 2005 legislative session. The fee will expire again on Jan. 1, 2010 unless it is extended by the state legislature.

When recycled properly, scrap tires have other beneficial uses. They can be made into playground surfaces, running tracks, recycled rubber products and can even be burned for fuel in power plants. In 2006 and 2007, more than 4 million tires were used as tire-derived-fuel in power plants. The department is also working with the Missouri Department of Transportation to promote the use of scrap tires in asphalt produced for Missouri road projects.

So a tire that was once a home for mosquitoes and other pests could become a belt or purse, protect a toddler from a nasty spill, help to light your home or even provide the road surface for you to travel on.

Hazardous Waste

Hazardous waste is still very prevalent in many areas of Missouri's environment. The department provides three major functions as they relate to hazardous waste, pollution prevention, environmental cleanup and long-term stewardship. First, along with waste minimization, proper management, treatment or disposal is critical to prevent the release of hazardous waste into the environment. Second, the program assists in cleanup of contaminated sites across the state.

Following cleanup, it is important to maintain long-term stewardship at the reclaimed sites.

Long-term stewardship is the maintenance of contaminated sites to ensure human and environmental health is protected for future generations.

E-scrap

One of the emerging issues facing our state and the nation is dealing with electronic waste. Also known as e-scrap, this waste includes such items as outdated computers, monitors, keyboards and mice; printers; televisions; cell phones and other types of hand held electronic devices. The department wants to prevent e-scrap from going into a landfill and potentially causing more contamination.

The department, in coordination

DNR file photo

Nearly 200 public and private Missouri schools participate in the School Chemical Cleanout Project.

Partnership Addresses Problem Decades in the Making

In post-World War II America, a surge in interest in science brought a new emphasis on this subject to Missouri's classrooms. As a result, many educators began to employ various chemicals in the classroom to help employ textbook lessons to life for their science and chemistry students.

Unfortunately, what began as a way to expand students' horizons later developed into an environmental and safety hazard for schools throughout Missouri. As teachers left their positions and were replaced, many of these chemicals were left in supply closets or basements, and new ones ordered. Soon school shelves were crammed full of jars and bottles, often with very little knowledge of where they came from or what they contained.

These chemicals are essentially hazardous waste. As some of these chemicals age they can degrade into shock-sensitive by-products, which can trigger a violent reaction or explosion simply by being moved or opened. While some schools wanted to address the issue, no funding was available to help them in this effort. Some schools undertook cleanups at their own expense, but others were unable to finance cleanups themselves.

In his capacity as associate director for the Missouri Center for Safe Schools, an organization that was established by the Missouri Department of Elementary and Secondary Education to promote safe and orderly schools, Russell S. Thompson began to notice this alarming trend.

"We have performed safety reviews in more than 130 school districts," Thompson said. "During our reviews, we identified the safe storage and management of hazardous chemicals in science labs, shops and other instructional areas, as a recurring problem. In collaboration with the Missouri Department of Natural Resources and others we began to study the problem and investigate strategies for improving school chemical hygiene several years ago."

The Department of Natural Resources worked with the Center for Safe Schools Workgroup, a multi-agency group made up of educators, regulators, safety professionals, insurance companies and private industry to research how best to assist schools in cleaning up these hazardous chemicals. The workgroup collaborated with experts from across the country to develop an educational CD and implemented pilot cleanup projects in four Missouri school districts. In early 2008, the department identified a funding source that was able to assist not only those schools that were already voluntarily participating, but hundreds more.

In 2008, the Center for Safe Schools, the Missouri Department of Elementary and Secondary Education and the Department of Natural Resources launched the 2008 School Chemical Cleanout Project. The goal is to remove and safely dispose of outdated, dangerous and unstable laboratory and instructional use chemicals from science and chemistry labs, storerooms and other classrooms in both public and private elementary, middle, vocational or high schools.

As of June 30, 2008, nearly 200 schools were participating in the program and in July the partnership announced a third open application period, providing another opportunity for additional schools to apply to be included in the program. The Department of Natural Resources created a grant application process that requires very little expense for eligible schools. The Department of Natural Resources pays for contractors to properly remove and dispose of the dangerous chemicals inventoried. This program also provides participating schools with educational materials that are designed to help ensure safe management practices in the future.

"As a former science teacher familiar with strange chemicals in school science lab closets, this project is a priority for me," said Department of Natural Resources Director Doyle Childers. "This program enables Missouri's schools to provide a quality education, while keeping our students and the environment safe."

with many stakeholders, has put together a process to promote e-cycling and local Missouri businesses that can assist in this process.

The Missouri Department of Natural Resources and its stakeholders support the need to recycle used or outdated electronic equipment. The department is working with the citizens of Missouri to provide them information on the many benefits of e-cycling, which include the protection of human health, maintaining a clean environment, the creation of local jobs, supporting local communities and the conservation of our state's natural resources.

Facts about E-scrap

- It is estimated that Americans own more than 500 million working and non-working televisions.
- The cathode ray tube in a television monitor can contain up to four pounds of lead.
- The National Safety Council esti-

Two million tons of consumer electronics require disposal each year. Many contain hazardous materials or chemicals.

Partnership Maintains the E-Cycle of Life for Electronics

Do you have an old computer collecting dust in the basement? An usable cell phone tucked away in the junk drawer in your kitchen? A television that's about to become obsolete? A computer monitor that no longer works? A keyboard, printer, mouse or hand-held device that's gone kaput? With more than 2 million electronic items being disposed of each year in the U.S., chances are, somewhere in your home or business is an electronic device that's longing for a second life.

This category of waste has been dubbed electronic scrap, or e-scrap. A single computer or older television can contain four pounds of lead, in addition to several other potential pollutants, including chromium, cadmium, mercury, beryllium, nickel, zinc and brominated flame retardants. With 2 million tons of consumer electronics across the country requiring disposal each year – and only about 20 percent being recycled – the risk to the environment is staggering. This ever-growing problem spurred development of an e-scrap stakeholder workgroup, an important partnership of private, public and non-profit recyclers; federal, state and local governments; national manufacturers and retail organizations, led by the Department of Natural Resources.

Together, the group put in place a framework for reusing, recycling and disposing of e-scrap in Missouri in an economically sustainable fashion, without threatening the environment. To accomplish this, the partnership developed a three-pronged strategy called e-cycle Missouri.

This strategy includes: A set of best management practices for electronic equipment recyclers and demanufacturers to follow; and a voluntary, four-tiered registration program, with each level representing an increased commitment to following the best management practices and adopting additional environmental controls.

Public Education and Outreach

Through this partnership, Missourians now have a safe alternative for disposing of unwanted electronic items. Since businesses, non-profits, schools and public agencies in Missouri are required by law to properly manage certain discarded electronics, the resources and services provided by e-cycle Missouri helps these entities remain in compliance.

Taking advantage of one of the numerous e-cycling services available through e-cycle Missouri helps ensure that the numerous harmful chemicals found in that itty bitty cell phone don't make their way into Missouri's drinking water. And to sweeten the deal, consider this: As the demand for electronics recycling grows, so will the need for new e-cycling businesses, especially in areas that don't already have drop-off centers. Those that do have centers will add staff to meet the growing need. Recycling e-scrap supports Missouri's economy. Donating these items to schools or communities for refurbishment provides them with equipment they might not otherwise be able to afford. E-cycling also helps conserve Missouri's natural resources. Computer circuit boards, for example, may contain gold, copper and other precious metals. Lead, glass and plastics are used in TV and computer monitors. By recovering and reusing these materials, we reduce the need to mine for new raw materials.

To learn more about how e-cycle Missouri can extend the life cycle of your unwanted electronics, visit www.e-cyclemo.org or call 1-800-361-4827.

mates that nearly 63 million computers became obsolete in 2005.

- The average life span of a computer has fallen from 4.5 years in 1992 to an estimated two years in 2005.
- An estimated 10.2 million used computers are exported from the U.S. each year. Most end up in countries that have less stringent environmental laws than in the United States.

Source: Basel Action Network

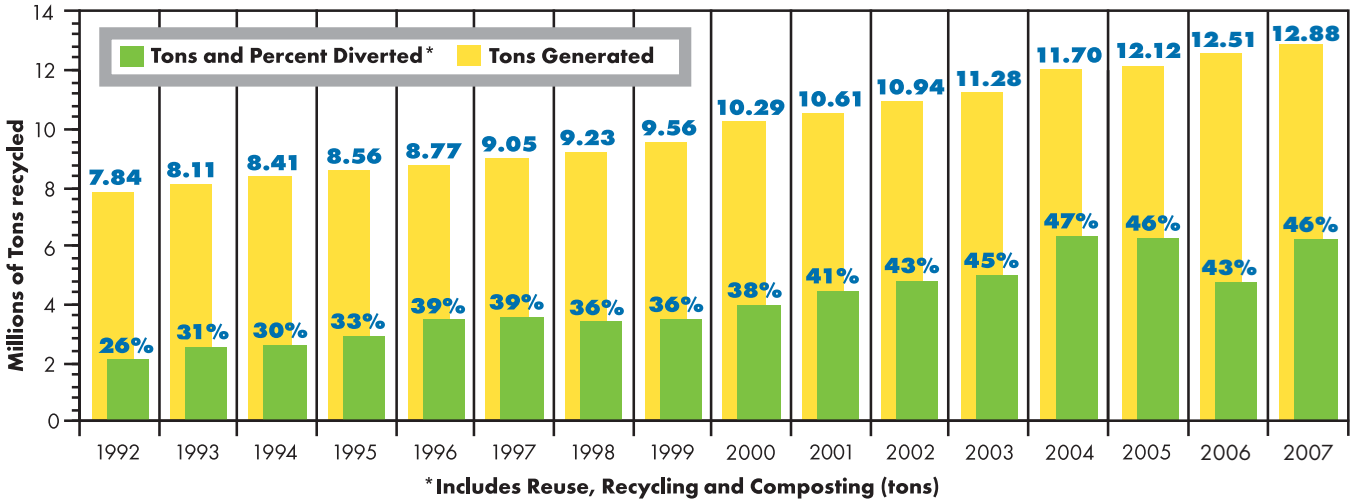
Pollution Prevention

Before an item or material becomes hazardous, the department works to prevent the improper disposal of hazardous materials. One way they accomplish this is to work with stakeholders to create a market to keep hazardous materials out of landfills or from being shipped to foreign countries which spreads the contamination.

Tank Inspections

The department is working with petroleum storage tank owners and operators to improve operational compliance and promote better practices to

Waste Generated and Waste Diverted From Missouri Landfills



reduce petroleum releases. The department provides assistance related to the operation, monitoring and maintenance of tanks that contain petroleum products or other hazardous substances. These efforts have improved the operator's awareness which in turn has reduced the number of petroleum releases and leaks. The Department of Natural Resources continues to work with the regulated community on a daily basis to provide a more consistent response to issues that are raised regarding petroleum storage tanks.

Environmental Cleanup Redevelopment

It is estimated there are more than 450,000 brownfields in the United States. Brownfields are abandoned, idled or underused industrial and commercial sites where expansion or redevelopment is complicated by real or perceived environmental contamination issues.

They can be in urban, suburban or rural areas across the state. The property owners, business operators, or prospective buyers want the property cleaned up to standards acceptable to the state and to receive some type of certification of the cleanup from the department. This certification can greatly reduce the environmental liability associated with such properties, increase the property value and allow unused or blighted properties to return to productive use. In Missouri, 344 brownfields sites are currently undergoing an investigation or cleanup. To date, 374 sites have been cleaned up and returned to productive use since program's inception in 1994.

Drycleaners

The Missouri Department of Natural Resources administers the Drycleaning Environmental Response Trust Fund, also known as the DERT Fund. The fund establishes monies to reimburse facilities for investigation, assessment and remediation of releases of chlorinated solvents from Missouri dry cleaning facilities. Coin-operated facilities are also subject to the requirements.

In spring 2006, the DERT Fund started accepting applications. There are 269 active dry cleaners in Missouri. The department is working with 21 drycleaners enrolled in the fund and is providing state oversight of investigation and cleanup activities for the program.

Lead Mining

Worldwide, lead contamination has been found in children's toys, jewelry and other everyday products. But in Missouri, often referred to as the nation's "lead belt," the lead issues are much bigger. Many counties are contaminated with lead from past and current mining practices.

Southeast Missouri has an extensive history of lead and zinc mining beginning in 1720 by French mining interests. Since that time 4,314 known individual explorations or mines have been registered in more than 50 of the 114 Missouri counties, with known production still occurring in 39 counties.

Currently Missouri is the number one lead producing state in the United States. There are still active lead mines in Missouri, and the second largest primary lead smelter in the world is in Herculaneum. Cleanup actions are in progress on and near the current lead mining sites and smelting site, and monitoring is ongoing.

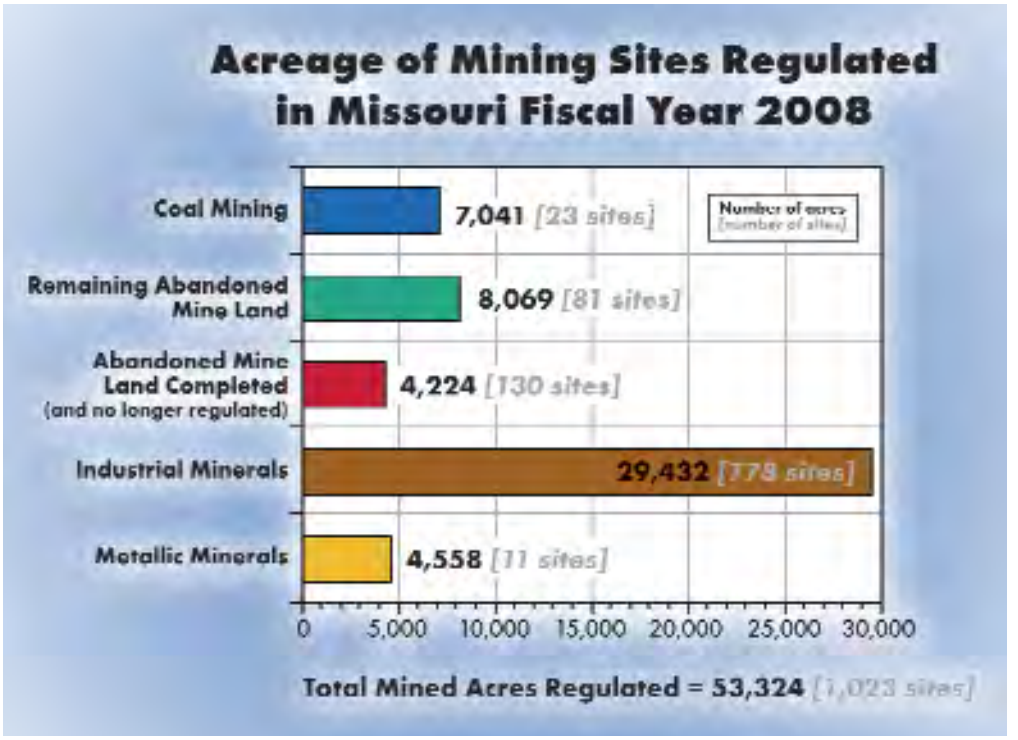
The department, in cooperation with EPA, has found lead contamination and continues to investigate at other various lead mining sites. The investigations evaluate and categorize sites based on their potential risk to human health and the environment.

Several large Superfund sites have vast areas that are undergoing lead cleanup. Once these cleanups are complete, there may be many years of monitoring or long-term stewardship.

After the Cleanup: Long-Term Stewardship

The department oversees long-term stewardship of many sites.

These sites may have contamination that cannot be cleaned up. When this happens, long-term stewardship comes in to the process. Long-term stewardship ensures the site remains protective of human health and the environment far into the future following the completion of cleanup, disposal or stabilization of material at a site or portion of a site. Long-term stewardship may include physical controls, legal controls, monitoring, maintaining public records and other mechanisms to ensure the site remains protected for as long as the hazards may exit. The department is responsible for overseeing that land use restrictions are upheld. Individuals involved in property transactions and construction should review land use restrictions. Local governments can also take part in this information distribution effort by applying this information in land use decisions and providing cleanup information to the members of their community.



Missouri Environmental Covenants Act

One way to ensure long-term stewardship is through the Missouri Environmental Covenants Act. The act went into effect on Jan. 1, 2008 to better protect the interests of all parties entering into a covenant. Environmental covenants are legal documents put in place when contamination is left on a site. These covenants are voluntary and provide a potentially powerful and efficient institutional control, precisely describing requisite future use limitations of the property.

The department uses covenants to restrict future use or future activities at properties where residual contamination remains in place. This protects the people from possible exposure to contamination and protects the surrounding areas from potential releases off-site.

Environmental covenants can be especially useful at notifying prospective property purchasers that environmental-related future-use conditions exist. An environmental covenant makes the property more marketable because future owners will know the department has reviewed the site and determined how to safely use the revitalized property.

The restrictive covenant also serves to limit the owner's environmental liability by memorializing the department's involvement and determination of the acceptable uses for the property. In so doing, the owner has made a good faith effort to transfer this important

Scrap-Tire Program Provides Purpose to Once-Useless Tires

Missouri Department of Corrections photo

Department of Natural Resources funding provided this scrap tire shredder for the Department of Corrections' Missouri Vocational Enterprises program.

If you've ever been unlucky enough to live next to an illegal tire dump, you know the drill: Keep the shades closed tight so you don't have to look at the unsightly eyesore. Avoid your backyard on summer nights, when the mosquitoes these dumps breed are particularly heavy. And keep your fingers crossed they don't catch fire, which can release a variety of dangerous toxins into the air you breathe and the water you drink. Sounds like a pretty crummy way to live, doesn't it? Unfortunately, it's been an unhealthy reality for numerous Missourians.

With funding from Missouri's Scrap Tire Fee, 15 million scrap tires have been cleaned up from 779 sites across Missouri since 1990. A large portion of these tires were cleaned up through a partnership among the Missouri Department of Corrections, the University of Missouri and the Missouri Department of Natural Resources. Through this partnership, illegal tire dumps are quickly becoming nothing more than a memory, and the once-useless tires are being used to power learning and life for thousands of college students in Missouri.

In the early 1990s, the Department of Natural Resources used a grant to fund a test burn of tire-derived fuel (TDF) at MU. With help from the Department of Natural Resources, MU retrofitted its power plant equipment and administered a testing program to ensure acceptable stack emissions. The Department of Natural Resources also funded the purchase of scrap-tire shredding equipment for the Department of Corrections' Missouri Vocational Enterprises.

The three organizations soon forged an innovative partnership. Inmates now help to clean up illegally dumped tires and give them a second life. Like all work-release prisoners, the offenders are near the end of their sentence and are carefully screened. After they collect the tires from illegal dumpsites, the tires are taken by truck to Central Missouri Correctional Center in Jefferson City, where they are processed into TDF. The building at CMCC contains a primary and secondary shredder, conveyer belts, a truck and a crossbelt magnet, which removes loose wires from shredded tires on the conveyer belt. Nine full-time civilian employees are involved in the program, along with about 45 offender workers. Prisoners from Algoa and Ozark Correctional Centers, as well as Western Reception, Diagnostic and Correctional Center in St. Joseph, all contribute to the program. Chips from the tires then go up a conveyer belt and ultimately to a truck. The material is then transported by tractor trailer to MU. The university mixes TDF with coal and burns the mixture to generate electricity.

The teamwork between Missouri Vocational Enterprises, MU and the Department of Natural Resources has reduced smokestack emissions at MU by 250 tons per year and is saving the university $100,000 per year in fuel expenses. The Missouri Waste Control Coalition recently presented the Department of Corrections, MU and the Department of Natural Resources the Outstanding Achievement in Government Award in recognition of this effort.

"This award demonstrates the department's commitment to the environment as well as public safety," Corrections Director Larry Crawford said. "This is hard work, but it's beneficial to the state when these tire dumps are cleaned up. It also teaches our offenders important job skills, which is important in reducing recidivism."

The partnership has also resulted in the cleanup and processing of nearly 4.8 million scrap tires and 286 dumpsites across the state of Missouri, and puts these tires to good use. These cleanups wouldn't be possible without the hard work of Missouri's low-custody prison inmates, who are making a significant contribution to Missouri's communities and helping to protect Missouri's air, land and water quality.

knowledge to future owners.

Assessment of Natural Resource Damages

The Natural Resources Damages program was developed to allow natural resources trustees, such as the Missouri Department of Natural Resources, to seek compensation for injuries to natural resources caused by hazardous substances contamination at various sites. Natural resources include land, fish, wildlife, surface water, groundwater and drinking water supplies. If unfeasible to restore a property, the department and other trustees can acquire the equivalent of the injured resources.

The department identifies injured sites and conducts assessments of injured natural resources to support damages claims. Claims are then filed against responsible parties, who are requested to provide monetary compensation for injured resources such as wildlife habitat or contaminated water, or conduct activities such as removal of contaminated sediment from streams.

For example, in southwest Missouri, the department is partnering with state, federal and local environmental agencies to develop a regional restoration plan. This plan will allow the depart-

Department Partners With State Farm to Address Earthquake Hazards

DNR photo by Hylan Beydler

State Farm Insurance presents a check for $26,000 to the Division of Geology and Land Survey to help fund an earthquake hazard mapping project at the division's offices in Rolla.

Studying earthquakes is uniquely challenging because they occur infrequently and they cannot be predicted. Scientists can, however, use geology to estimate the amount of shaking (or ground motion) that is likely to occur as a result of an earthquake. This is commonly referred to as "earthquake hazard." The hazard depends on many factors such as depth and magnitude of the earthquake and the physical properties of the rocks and sediments.

One of the largest earthquakes in history occurred in New Madrid on Feb. 7, 1812. The earthquake exceeded the magnitude of California's Great 1906 San Francisco Earthquake. Scientists believe it would have registered greater than magnitude 7.5. The New Madrid Seismic Zone is located in southeastern Missouri, northeastern Arkansas, western Tennessee, western Kentucky and southern Illinois. Southwestern Indiana and northwestern Mississippi are also close enough to receive significant shaking from large earthquakes occurring in the zone. The New Madrid Seismic Zone is the most active seismic area in the U.S. east of the Rocky Mountains. More than 200 small earthquakes occur each year along this zone. The April 18, 2008, Mt. Carmel earthquake in eastern Illinois focused attention on this area.

Because of the seismic history of the New Madrid Seismic Zone and its proximity to the St. Louis urban area, the St. Louis Area Earthquake Hazards Mapping Project is producing geologic and earthquake hazard maps for the St. Louis metropolitan area. This is a cooperative effort among federal, state and university partners.

Recently, State Farm Insurance pledged support to the project and provided much needed resources for an earthquake hazard mapping project under way at the department's Division of Geology and Land Survey in Rolla. The partnership between the department and State Farm Insurance will further the department's work to create detailed surficial materials maps for the Greater St. Louis area. All the information and maps generated by the project will be made available to the general public.

Public and private groups can use earthquake hazard maps for land use planning, emergency response efforts, hazard mitigation and infrastructure development in order to minimize damage resulting from earthquake shaking. Managers in banking and insurance can use these maps to better define risk exposure and loss estimates.

"State Farm is proud to partner with the Missouri Department of Natural Resources," said State Farm Agency field executive Nicole Latimer. "We are in the business of helping our customers recover from the unexpected. The knowledge gained from these hazard maps will help everyone better understand and prepare for the varying risks in the New Madrid Seismic Zone." State Farm's headquarters is in Bloomington, Ill., with offices throughout the nation and in Canada.

Nearly 200 years of population growth in the region, which includes metropolitan areas such as St. Louis and Memphis, means that a repeat of the 1812 earthquake could cause considerably more damage. A similar size earthquake occurring along this zone in this century has the potential to significantly impact Missouri. Because of the proximity to the New Madrid Seismic Zone, portions of the St. Louis area are at risk from a major earthquake.

When damaging earthquakes occur, most casualties result from partial building collapses, falling objects and debris, such as toppling chimneys, falling bricks, ceiling plaster and light fixtures.

ment and other trustees to speed up restoration of the injured resources.

Mining

Imagine a land so barren and without vegetation that it has earned the nickname "moonscape." Because of past mining practices, this has become a reality in many parts of Missouri. When acidic materials are exposed on the soil surface as a result of mining, those soils will not support a vegetative cover and have a lunar like appearance. In the past, strip mining allowed acid mine wastes to seep into local waters, resulting in degradation of aquatic habitat and diminished water quality.

Although coal mining in Missouri has decreased in recent years, the need to reclaim any land previously disturbed by strip mining remains. Businesses and communities have worked diligently with the department to clean up these mines. In fact, 105,414 cumulative acres have been returned to productive use through FY08.

The Department of Natural Resources also handles permits, complaints and enforcement for 812 metallic, industrial mineral and coal sites and manages the reclamation of abandoned and inactive coal mine sites.

Unfortunately, much reclamation work remains but few resources are available to do it. There is limited funding to reclaim old coal mine sites and no state funding available to reclaim

old mine sites that were created prior to the state's mine site permit system.

Missouri enforces the Missouri Coal Regulatory Program in addition to having the Abandoned Mine Lands Program, which funds coal mine cleanups of abandoned mines using fees paid by coal operators.

Abandoned lead-zinc and coal mines continue to impair waters decades after mining has ceased. A tax on coal has funded efforts to clean up coal-mined lands nationwide. This tax, collected at the federal level, was scheduled to expire in 2007.

However, the abandoned mine land reauthorization, which amended the 1977 Surface Mining Control Act, was signed into law on Dec. 20, 2006. This extended the Missouri Abandoned Mine Land Program funding until 2021. Twenty-five years of work through the abandoned mine land program and other programs in Missouri have reduced the number of stream miles impaired by acid mine drainage from about 100 to 15, but long-term effects most likely will remain. The department's Division of Geology and Land Survey continues to inventory the several thousand lead, zinc and barite mines to assist in prioritizing future sites for mined-land cleanups.

Missouri currently has more than 7,000 acres of coal mine land, both active and forfeited, that require monthly inspections for active mines and yearly inspections for forfeited mines. In addition, there are more than 29,000 acres of industrial minerals including rock, gravel and clay quarries, and more than 4,500 acres of metallic minerals waste disposal areas that require less-frequent inspections.

Commercial sand and gravel mining operations require a permit to engage in surface mining issued by the department. In-stream sand and gravel mining operations mine in accordance with a Sand and Gravel Excavation Plan. Open pit operators mining in a floodplain follow a mine plan that is reviewed by inspected by the department. General permits for storm water runoff are required of all sand and gravel processing and washing operations.

In an early journal entry, explorer William Clark described one of Missouri's most abundant natural resources, limestone. Although we may pay little attention to the limestone quarry we pass alongside the highway, we depend on products derived from that quarry in our everyday lives. These raw materials are key components in construction of roads, bridges, buildings, homes and numerous other products that are essential to our way of life.

Development of Missouri's abundant supply of limestone is just one example of the important role geology plays in our state's economy. The Department of Natural Resources produces and disseminates geologic and hydrologic information to be used for environmental and human health safety decisions.

Geologic and Hydrologic Information Available

Some of the most widely-used information includes the ever-growing collection of geologic maps depicting surficial material and its underlying bedrock geology resources.

A national study determined that the value of this type of data exceeds the cost of developing the data by 25 times. From an economic perspective, Missouri must continue to produce and provide this information in a format usable by all types of decision-makers to protect citizens, assist developers and protect the environment.

Electronic databases created and maintained by the department are readily available to the public. This information is routinely used in the siting, monitoring and cleanup of all types of waste sites throughout the state.

Geologic and hydrologic information can be used to predict earthquake risk, sinkhole collapse, sites where landslide may occur, areas where a limestone quarry could be developed, places where wells could be drilled to meet specific needs and where a landfill could be safely located.

Increased Interest in Oil and Gas Potential

Record oil and gas prices contribute to increased interest in oil and gas potential in Missouri. Compared to 2007, applications for oil and gas exploration to the Missouri Department of Natural Resources' State Oil and Gas Council have more than doubled in the first three quarters of 2008.

In 2005, the department received 25 applications. Since 2006, the number of applications received quadrupled and the numbers continue to grow:

- 330 applications in the first three quarters of 2008 with Missouri oil averaging $86-$102 per barrel
- 129 applications in 2007, averaging $61 per barrel
- 41 applications in 2006, averaging $57 per barrel
- 25 applications in 2005, averaging $50 per barrel

All types of energy resources need to be evaluated in today's world. While interest in Missouri's heavy oil has significantly increased with higher energy prices, we must make sure we develop any energy resource in a safe and responsible manner.

To protect the environment, applicants must adhere to rules and regulations set forth by the Missouri State Oil and Gas Council.

The council publishes rules and regulations that apply to oil and gas drilling and producing operations to foster and promote orderly and economic development, production and use of oil and gas. Missouri state regulations for protecting the environment must be met at every step. Wells must be bonded to ensure that they are properly plugged should an owner improperly abandon a well.

The department's Division of Geology and Land Survey is responsible for approving permit applications for oil and gas exploration in the state of Missouri.

Abundant Resources

Limestone, clay, granite, sandstone, and sand and gravel are all abundant resources in Missouri. The limestone industry alone, contributes $1 billion annually, to Missouri's economy. The diverse uses of limestone are numerous, ranging from agricultural applications to building materials to medicines. These raw materials are key components of roads, bridges, buildings, homes and numerous other products that allow our communities and citizens to maintain a high standard of living.

The state is dependent upon this industry for so much of our future economic development. The department wants to assist the mining industry in enhancing production in an efficient and environmentally safe manner.

Development of Missouri's abundant supply of limestone and other rocks and minerals is just one example of the important role geology plays in our state's economy.

A nine-member council, appointed this year by Department of Natural Resources Director Doyle Childers, will provide guidance to the department to more effectively meet the industry's technical information needs. The group's expertise will help guide the department regarding geologic support to the industrial minerals producers in the state.

The Industrial Minerals Advisory Council is made up of leaders in our state's industrial minerals industry (limestone, granite, clay, sandstone, sand and gravel). These members are joined by one additional council representative from the Missouri Department of Transportation.

The Missouri legislature created the council and enacted legislation last year, establishing the Geologic Resources Fund. The legislation allows the department to collect, process, manage and distribute information pertaining to mineral resource potential to provide high quality, geologic and hydrologic information to the mineral industry to help that sector make sound environmental and economic decisions.

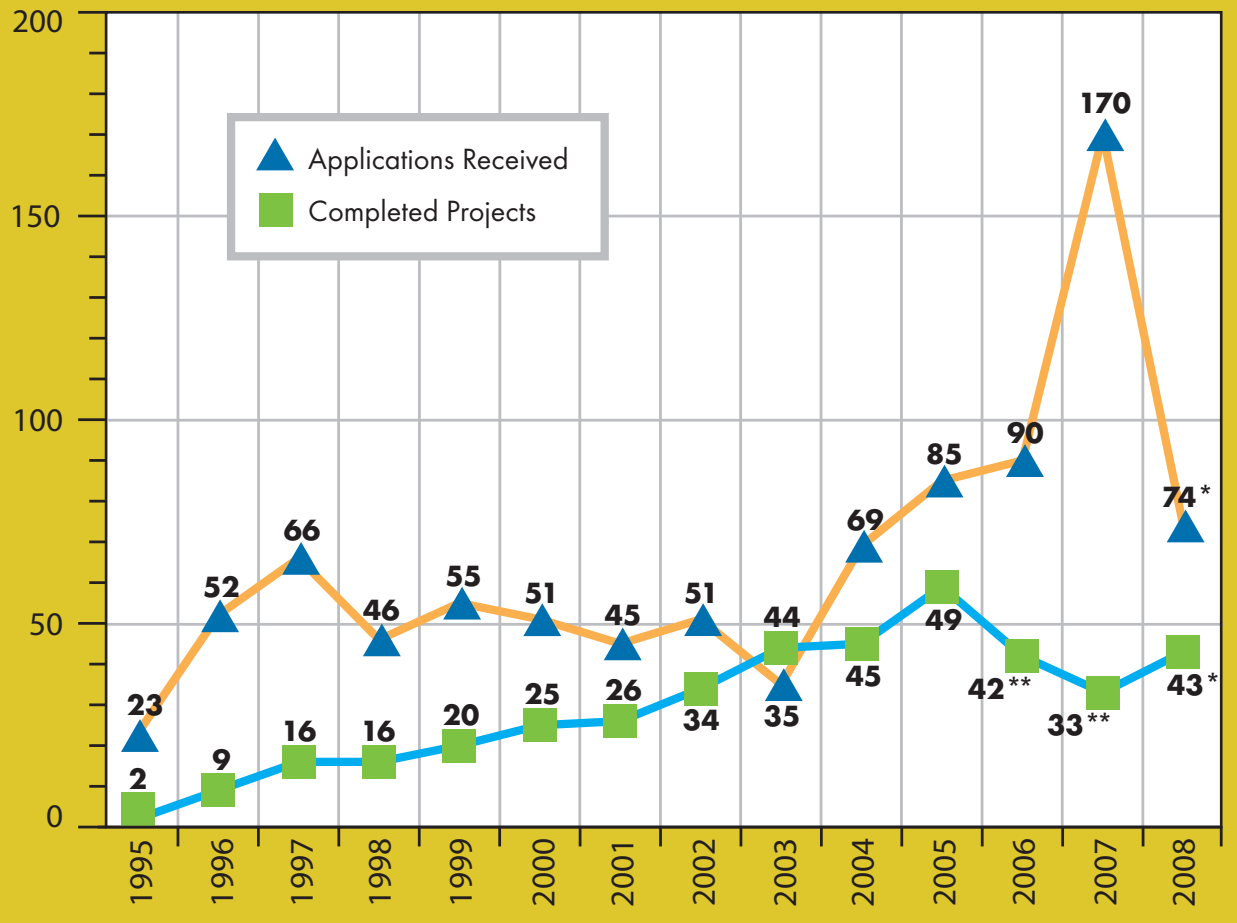
Discussing issues and challenges with these leaders clearly puts us on a path to better cooperation with the industrial minerals producers in Missouri, while at the same time, helping to protect the environment. The state geologist and director of the

Geodetic Control Network in Missouri

One of the areas of responsibility for the department's Land Survey Program is the preservation and extension of the geodetic control network in the state. This network of highly accurate surveying monuments is commonly referred to as horizontal, vertical control monuments (benchmarks), or Missouri Geographic Reference System Stations (GRS). Geodetic surveys determine the precise position of the monuments on the earth's surface, taking into account the shape, size and curvature of the earth. Geodetic surveys can be used to cover very large areas when the result-

Brownfields/Voluntary Cleanup Program

Applications/Completions by Calendar Year 1995-2008



*Total completed or applications received as of October 2008

** The decline in completions in 2006 and 2007 is partly due to a transition to new project managers and the record number of Voluntary Cleanup Program applications received. The 170 applications received in 2007 occurred after our ombudsmen initiated a special effort to focus on brownfield cleanups. That total was nearly three times the yearly average received since 2000.

Photo courtesy of city of Cape Girardeau

This photo was taken shortly after a sinkhole collapsed Friday, Feb. 22, 2008, in southeast Cape Girardeau. The surface opening is about 25 feet in diameter and at least 20 feet deep. The rock mound on the opposite side of the railroad tracks covers an earlier collapse.

Department Partners With Multiple Agencies to Put Cape Girardeau Back On Solid Ground

Anyone who has pulled a hot cake from the oven is probably familiar with the cracking, sinking and subsequent crater left behind on the surface of the cake as it cools. Now picture large sunken holes like this popping up without warning throughout your community.

This is the dilemma facing city officials, utilities, businesses and home owners in Cape Girardeau, after more than 20 sinkholes appeared in the city beginning in August 2007. One of the collapses resulted in a gas-main break and forced the local utility company to relocate gas lines and overhead power lines. The sinkholes also continue to pose a threat to the city's only wastewater treatment plant and main sewage trunk line, which are in the vicinity of the sinkholes.

"The destabilization of the infrastructure potentially impacts many local citizens and businesses that rely on the electric, gas and water lines in the area," said Peter Price, chief of the Environmental Geology Section in the Missouri Department of Natural Resources' Geological Survey Program. " The city would incur significant costs if the wastewater treatment plant were affected, and local water quality would be put at risk ... ." In addition to the headaches these sinkholes have caused for local utilities, they've also forced the closure of the major roadway and bridge over Cape La Croix Creek several times. Two railroads have taken measures to stabilize and monitor their tracks and bridges in the region.

"Also of concern to the City of Cape Girardeau is the impact to the local economy from the loss of business from the quarry, the railroads or other businesses." Price said.

Several factors, including the region's unique geology and recent weather patterns, contributed to the situation. The bedrock in this region is limestone, a carbonate bedrock that is susceptible to the formation of karst features, such as sinkholes, caves, deeply weathered fractures, springs and losing streams. A deep quarry nearby that draws groundwater toward it has also contributed to the situation as has heavy precipitation and flooding during 2008.

The U.S. Army Corps of Engineers has formed a multi-agency task force that includes U.S. Geological Survey's Missouri Water Science Center, the City of Cape Girardeau, SEMO Port Authority, Buzzi-Unicem Quarry, Delta Company Quarry, AmerenUE, Burlington Northern Santa Fe Railroad and the Department of Natural Resources' Geological Survey Program. Staff from the Department of Natural Resources are aiding this effort by providing geologic and hydrologic technical assistance, which they hope will help predict areas that are most at risk for future collapse.

The Department of Natural Resources' Geological Survey Program collected data along 17 transects, or cross cuts, through geophysical surveys that have identified several areas of potential weakness in the bedrock. The information being gathered by the department and its partners has been compiled for use in a task force report, which will detail the findings of the investigations and offers recommendations for further investigation and mitigation.

Sinkhole collapses occur in many regions of Missouri, especially in the southern portion of the state where karst topography is common. For more information on addressing sinkholes, contact the department's Geological Survey Program at 573-368-2100 or visit www.dnr.mo.gov/geology/geosrv/geores/geohazhp.htm for more information.

the shape, size and curvature of the earth. Geodetic surveys can be used to cover very large areas when the resulting accuracy and precision can not be obtained by ordinary surveying methods. Today, geodetic surveying is being done with the use of the Global Positioning System (GPS), which employs a network of satellites orbiting 12,500 miles above the earth.

The geodetic survey monuments provide a permanent reference for surveys, corners of the United States Public Land Survey System, control for aerial photography and mapping, engineering surveys, and the framework for county-level Geographic Information Systems or Land Information Systems.

The monumented points are generally aluminum or brass tablets three to four inches in diameter set in concrete posts flush with the ground. The disks are stamped with the information that includes the surveyor's name, year and agency that set the mark. The technical data for these markers are available through the Land Survey Program.

DNR file photo

Moniteau County survey marker.

Measuring Missouri

State, County Partnerships Help Maintain Detailed Survey Records Across the State

Nearly 200 years ago, land surveyors established property boundaries using wooden posts driven into the ground, surrounded by stones on top of sod mounds located on Missouri's prairies. Realizing these crude wooden stakes or rock piles wouldn't last long, later surveyors used more permanent monuments: set stones, iron pipes, axles, gun barrels or rock piles.

In the late 1960s, surveyors estimated that about 90 percent of the 225,000 original property boundary corners that were established in Missouri between 1815 and 1855 had been destroyed because of the immense changes in our state – roads, cities, towns, division of land, farming and timber cutting. The State of Missouri soon created the State Land Survey Authority, which later became the Missouri Department of Natural Resources' Land Survey Program, to help restore these corner monuments and to continue to maintain them on an annual basis. Now, land surveyors and staff with the Department of Natural Resources are working to keep pace with the changes that have been introduced through the use of Global Positioning Systems, or GPS.

"Since the mid-1970s surveying measurement technology and techniques have changed dramatically ... from literally a steel tape to measure a distance to using satellites," said Dick Elgin, county surveyor for Phelps County.

According to Elgin, though surveying equipment technology has changed, boundary location has not. Though the availability of technology like GPS has greatly improved the process since the days of rock piles and gun barrels, surveyors must still use a variety of techniques to establish accurate corners. Surveyors acquire all the relevant evidence possible, both field and record documents, coupled with field measurement data.

"GPS is not a magic device that can locate a property corner," said Darrell Pratte, geodetic survey chief, acting state land surveyor and acting program director for the Land Survey Program. "It is a very accurate way to measure distances between known marks. Using a coordinate system such as latitude and longitude or the Missouri Geographic Reference System a mark can be spatially located and, if lost, replaced using GPS and the mathematically developed coordinate system to which it is tied."

The Department of Natural Resources' Land Survey Program cooperatively funds the projects and prioritizes the areas with the largest needs for corner restoration. The department also is the lead and has the statutory responsibility to maintain the U.S. Public Land Survey System in Missouri. The USPLSS is the basis for all real property in the state; it is the system used to transfer land from the federal government to its citizens, and the beginning of all record title in Missouri.

"The genesis of every parcel lies with the corners set during the first half of the 19th century," Pratte said. "The USPLSS corners were placed at one-half mile intervals across all of Missouri. This was a large undertaking and in the early 1800s the contracts being let by the General Land Office were the biggest thing the United States government had ever done."

Each year, the program enters into contracts with county commissions and county surveyors across the state. County surveyors first submit an application with the history of the corner. After the Land Survey Program has reviewed and approved the application, the surveyor then establishes a 2-1/2 inch by 36-inch aluminum monument, provided by the Department of Natural Resources, at the corner. After the monument is set, the surveyor notes new trees or other references and submits a restored Land Corner Document to the Land Survey Program, as well as the local county recorder or county surveyor's office. In fiscal year 2008, 42 counties participated in the program, and 343 corners of the USPLSS were updated. These updates cost the department's Land Survey Program $68,000, or $200 per corner.

"The Land Survey Program would have paid more than twice this amount for the same product if the county commissions and the county surveyors had not partnered with us to get this work completed," Pratte said. "It is because of the financial support of these officials that we are able to continue to take on these types of projects."

The Land Survey Program assists the boundary surveyor by providing a repository of surveys and land corner documents, which surveyors can use to research the extent of previous survey work in an area. This information helps surveyors perpetuate a corner's position.

This partnership among county commissions, county surveyors, private surveyors and state and federal agencies helps maintain the monument corners, which serve as the basis for all land titles in Missouri. Private surveyors are required to use these corner monuments for all boundary surveys, which helps prevent litigation and property dispute.

"With accurate, dependable, well-monumented and documented land corners, the locations of boundaries are more well known, more settled and less likely to be the subject of controversy and litigation," Elgin said.

Photo by Elgin Surveying

Phelps County surveyors take ties to a corner of the U.S. Public Land Survey System.

More than 13,000 of these monuments exist in Missouri and there is a need for more. Two such monuments can be seen by visiting the historic Woman's Building on the grounds of the Missouri State Fair in Sedalia and inside the Land Survey Program's building in Rolla. Be sure to bring your handheld GPS and you will be able to check the location coordinates yourself.

Land Survey Index Online

Visitors to the Land Survey Program's Web site are now able to perform a number of searches from their home computers 24 hours a day, seven days a week, on the vast holdings at the Division of Geology and Land Survey's Repository in Rolla.

Land Survey documents are provided to the public in ever increasing numbers. Today, customer requests that used to require extensive hands-on research and paperwork can now be completed and available in a fraction of the time.

Searches on the Land Survey Index include legal descriptions (township, range and section), subdivision plats, U.S. survey number, General Land Office plats and field notes by township, surveyor name or number. City of St. Louis city blocks and roads are also shown with the data.

The online Land Survey Index provides the ability to research and order any of the 1.3 million survey documents available from the department's Land Records Repository. A popular and efficient method for completing your search is by using the "subdivision plats" search feature.

For example, a query on "Phelps County" for subdivisions named "Brown" yields 12 survey records, including those named Brown, Browns and Brownwood.

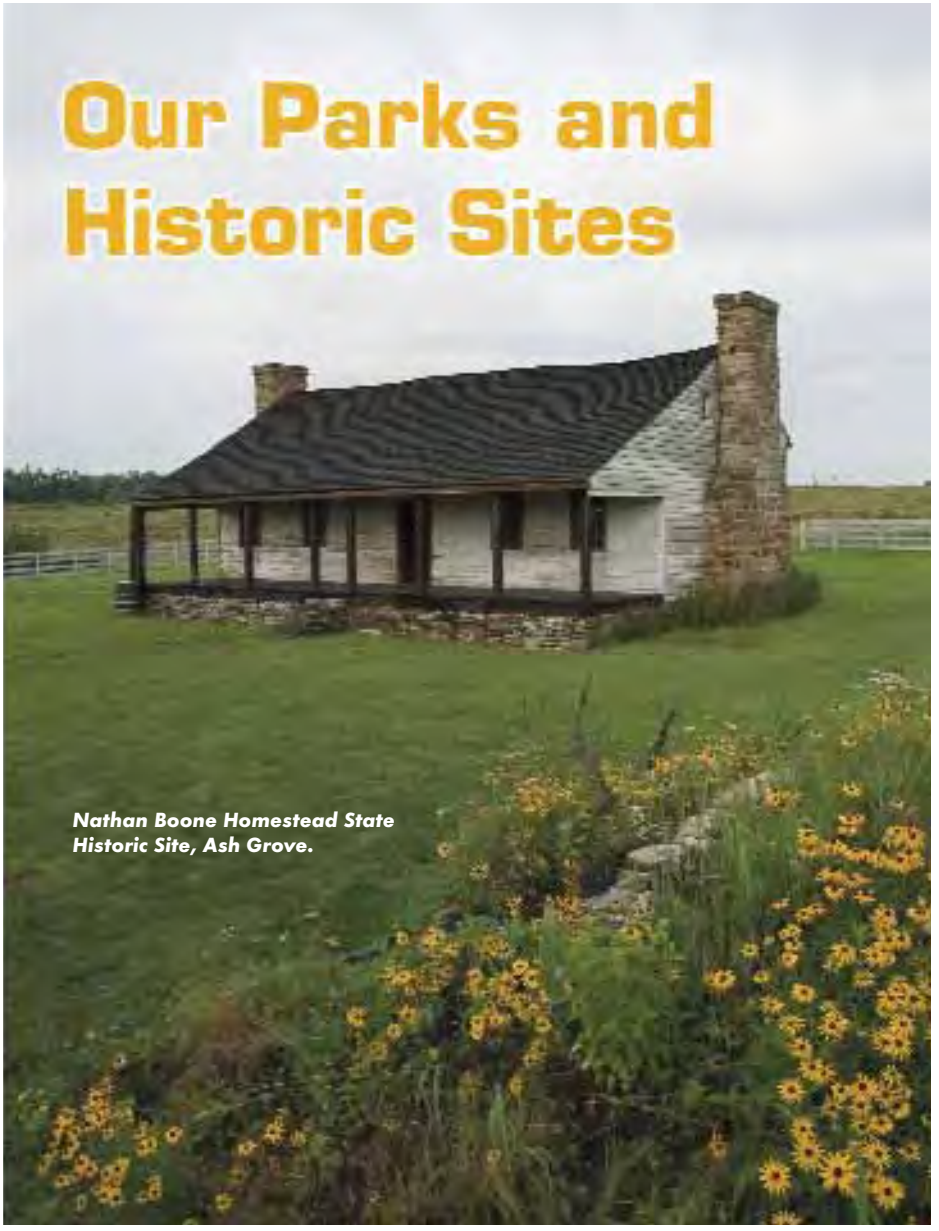
The document date, the surveyor's name or number, and other references are returned that aid the person requesting the information. The information also helps staff at the state land surveyor's office in filling customer orders for plats, field notes and other requested boundary documents.

Citizens are encouraged to check out

CHALLENGES: Protecting Our Land

- As the department continues to implement a risk-based corrective action process to address soil and groundwater contamination, ensuring the protection of public health and the environment is critical. Among other measures, the department must develop and implement a long-term stewardship program. Long-term stewardship needs to be implemented so that communities, prospective purchasers, lenders, developers, construction workers and the public can ensure that sites remain safe for intended future use, when contamination remains. This requires resources and staff dedicated to this effort. These resources do not currently exist.
- The federal Energy Policy Act of 2005 included new federal requirements for underground storage tanks to continue to reduce the threat of petroleum releases. Implementing the new federal requirements will be a challenge for the department during the next two to five years.
- The department must continue to balance economics and environment by ensuring mineral extraction is conducted in a sustainable, environmentally sound manner.
- End-of-life electronics, or e-scrap, is increasing the waste stream and contains potentially harmful substances. A quarter billion computers in the U.S. will become obsolete in the next five years. When television goes from analog to digital broadcasting in February 2009, many TVs will find their way to landfills as new TVs are sold. These materials must be handled safely and avenues for recycling and reuse need to be further explored.
- Missouri must continue to strive for better, safer and more convenient disposal of solid and household hazardous wastes while also encouraging residents to minimize their generation of waste and to recycle and reuse as much as possible.
- Missouri struggles annually to fund all our environmental activities. Missouri needs a reliable, stable funding source for hazardous waste protection and all of our natural resources.

Our Parks and Historic Sites



Nathan Boone Homestead State Historic Site, Ash Grove.

Missouri state parks and historic sites are the showcases of Missouri. Within their boundaries, visitors can step back in time at a Civil War battlefield or step down a boardwalk that takes them into a collapsed cave system. The areas are protected so visitors can experience our natural resources as they should be – clean air, clean water and preserved landscapes.

Missouri legislation creating a state park system was passed in 1917 and the first state park tracts were acquired in 1924. Today, the system includes 85 state parks and historic sites encompassing more than 140,000 acres, plus access to 61,000 acres in the Roger Pryor Pioneer Backcountry. Approximately 16 million people annually visit the state parks and historic sites. The park system also provides an estimated annual economic impact to Missouri's economy of $538 million.

The mission of the state park system is to preserve and interpret the state's most outstanding natural landscapes and cultural landmarks and to provide recreational opportunities. To accomplish this mission, the state park system preserves pieces of Missouri's history, its most outstanding natural features. Within these places are many opportunities for recreation.

During 2007, a significant accomplishment was the final agreement reached between the state and AmerenUE concerning the breach of the Taum Sauk reservoir that damaged much of Johnson's Shut-Ins State Park. The total settlement package represents a value of $179,750,000. Part of the agreement stipulates that Ameren would rebuild and restore Johnson's Shut-Ins State Park. Design and engineering work had already begun on the park's long-term redevelopment plan, which had been approved by the public. The agreement signaled the next phase of the plan with the actual redevelopment of the park. The park is scheduled to be rebuilt and reopened in 2009. The park will include a new campground in the nearby area of Goggins Mountain, a stream restoration project that allows more access along the East Fork of the Black River, more day-use activities in the valley area of the park, an orientation center, and a new shut-ins boardwalk.

A part of the Taum Sauk settlement included a license and funding to build a trail alongside the old Rock Island Railroad from Windsor to Pleasant Hill, which will allow a connection from Katy Trail State Park into the Kansas City area. Planning for this connection is already under way.

Another significant accomplishment in 2007 was an agreement between the Department of Natural Resources and the Missouri Department of Conservation to add a new state park to the system. Current River State Park will be developed on the property of the former Alton Box Co. corporate retreat and Jerry J. Presley Conservation Education, which was transferred to the department from MDC. The park, approximately 800 acres, is located in Shannon County on the Current River and will represent the return of the park system to the Current River. The main facilities of the park should be open to the public in 2010. Funds from Taum Sauk reservoir settlement also will be used to develop this new state park.

The department has begun preparations for the sesquicentennial of the Civil War. A major accomplishment toward this effort was the acquisition in 2008 of 40 acres associated with the Battle of Island Mound, one of the most significant milestones in the Civil War. The skirmish was the first time black soldiers engaged in combat during the Civil War. The site is located near Butler in Bates County and the department plans to open the site in 2012 on the 150th anniversary of the battle.

The Missouri state park system has consistently been ranked as one of the best state park systems in the nation and

Missourians Enjoy the Benefits of Boy Scout Efforts

DNR photo by Sue Holst

In 2007, more than 400 Boy Scouts volunteered 4,200 hours to help cleanup and recovery efforts at Johnson's Shut-Ins State Park.

When it comes to protecting nature, it sometimes takes patience to see the fruit of your efforts. But one local group of Boy Scouts doesn't mind the wait.

The Boy Scouts of America Greater St. Louis Area Council, Shawnee Lodge undertook a large and challenging project: helping repair the damage done at Johnson's Shut-Ins State Park as the result of the Taum Sauk reservoir breach, and helping to restore the park to its original condition.

Shawnee Lodge covers a portion of eastern Missouri for the Order of the Arrow, Scouting's national honor society. The lodge initiated this important project in 2007 as part of its One Day of Service. Because of the project's resounding success – 440 Boy Scouts volunteered 4,200 hours to the project in 2007 – the Order of the Arrow sponsored another event in 2008. Volunteers donated another 2,200 hours of their time. During the two projects, they planted a total of more than 4,000 trees, pulled thousands of cottonwood seedlings from a recovering "fen" wetland, gathered rocks for structures, and built several miles of trails. They also helped the Missouri Department of Natural Resources take a significant step toward the park's recovery.

For Bruce Levitt, One Day of Service Adviser for Shawnee Lodge, what makes this project special is the opportunity to bring Boy Scouts back each year to see the impact of the previous year's work, teaching them that the previous year's efforts were beneficial and measurable. He also feels this is an ideal opportunity to teach them that by continuing to build on their efforts each year, they can contribute to a real transformation of Johnson's Shut-Ins State Park. The nature of the project also brought together Scouts of all ages, from age 11 to 70 plus.

"Many a scout, young and old, has memories of the park, the Scout camping area, and swimming in the shut-ins," Levitt said. "We believed that Scouts providing our unique abilities (many hands make light work) of service, could be a benefit to the park and make a difference. We were interested in making a substantial contribution to restoring this park that we use so often."

This project also helps Scouts bring the words of their oath and Scouting laws to life. For example, each Scout pledges to do his best; Levitt points to the exceptional survival rate of the trees the young men have planted as evidence of their commitment to ensuring things are done the right way. The Scout law guides Scouts to be trustworthy; Levitt notes that the department trusted the Scouts with hundreds of tools that they used correctly and responsibly.

"We believe that a weekend of service to others is a key way to allow Scouts to make and demonstrate an ethical and moral choice," Levitt said. "These young men have many activities competing for their time. But they chose to participate in the One Day of Service ... making a choice of service, certainly demonstrating moral and ethical behavior."

Our state parks and historic sites belong to every Missourian, and every Missourian has benefited from the thousands of hours of volunteer service put forth by Shawnee Lodge. They have helped to repair damage to a state park that has been a gathering place for hundreds of thousands of Missourians for decades.

"The young Scouts who have helped repair the damage to Johnson's Shut-Ins State Park have made a significant contribution not only to the health of the park, but the health of our collective morale as well," said Doug Eiken, director of the department's Division of State Parks.

And for the Boy Scouts who patiently return each year to see the fruit of their efforts realized, perhaps one day they'll bring their own families to visit a park that they helped repair.

has a very high satisfaction rating with visitors. Based on input gathered through guest comment cards distributed throughout state parks and historic sites, overall visitor satisfaction in 2007 was 97 percent. Through a visitor survey in six specific state parks and historic sites, the visitor satisfaction rating was 99 percent.

The Department of Natural Resources is able to operate this high-quality state park system because of the stable source of funding from the parks, soils and water sales tax. This one-tenth-of-one-percent sales tax is divided equally between the state park system and efforts to stop soil erosion, both within the Department of Natural Resources. The tax was first approved by voters in 1984. A 10-year extension of the tax has been approved overwhelmingly three times by voters. The latest vote in 2006 was approved by 70.8 percent of voters, the highest approval rate. This sales tax provides funds for three-quarters of the state park system's budget, with the other funds coming from revenue generated in parks and sites.

Infrastructure is often unnoticed but vital to the park system to protect resources. Infrastructure improvements have included upgrading water and

sewer systems, closing abandoned lagoons and developing new drinking water distribution and storage systems. To make the most of new green technology, a solar-powered horse watering facility was installed along the equestrian trail at Cuivre River State Park.

A new maintenance journal system has been implemented. This new system tracks all maintenance, repair and replacement activities as well as projecting future work lists and cyclical maintenance actions. Throughout the system, numerous buildings were painted, repaired or remodeled and roofs were replaced. Cabins and lodging facilities were repaired or remodeled.

Campground improvements continue to be a priority. These improvements included increasing the number of electrical campsites, upgrading existing electrical campsites and renovating shower houses and restrooms. In the last three years, approximately 700 basic campsites have been upgraded with electricity. This achieved the goal of having 70 percent of the state park system's 3,500 campsites offering electricity, which is more in step with demand.

Another major improvement has been the availability of new camping experiences. Camper cabins have been added at Mark Twain State Park and Stockton State Park plus a yurt has been added at Lake of the Ozarks State Park. The latest addition is four camper cabins that were added to Lake Wappapello State Park in 2007.

State park staff continued to reach out to visitors and citizens through a variety of ways, including a variety of special events from spring wildflower walks to historic festivals. Interpretive contacts by staff through programs and other venues reached almost 1.6 million in 2007. Fifty-six informational meetings and open houses were held at state parks and historic sites with more than 3,580 people attending in 2007.

In an effort to reach visitors who may not be familiar with the state park system, the department's Division of State Parks is expanding its urban outreach efforts. In addition to its annual WOW National Outdoor Recreation and Conservation School in St. Louis, the division is helping to sponsor WOW efforts in Kansas City, Springfield and Columbia. These events familiarize urban participants with outdoor recreation skills and opportunities.

The division also created a Kansas City area office in the Discovery Center in Kansas City. This office mirrors the one in St. Louis so the division now has urban outreach efforts in the state's two largest urban areas.

The division is continuing to look to the future, realizing that is the only way it can keep up with what the public needs while addressing tighter budgets.

Campers from St. Louis visit Cuivre River State Park near Troy.

One way this is being accomplished is through the "visioning" process, which looks ahead to demands for new services and changing trends as well as ways to address them efficiently with limited resources. One efficiency identified established a historic construction crew with specialized preservation skills that can repair historic buildings in a more timely and cost-effective manner. Another efficiency was the development of an online reservation system to make it easier to reserve tours of the State Capitol and other historic sites.

Another major challenge of the future is finding a way to help children reconnect with nature and the outdoors. This is also a national trend that shows children no longer spend time and connect with the outdoors as past generations. The state park system has begun to address this challenge with an initiative called "Get Out and Play." This initiative will continue for several years.

Protecting the state park system's natural and cultural resources while providing quality customer service will remain the commitment of the Department of Natural Resources. By addressing some of these long-term issues, the state park system will be able to continue to use tax dollars wisely and efficiently as it looks toward the next 10 years and beyond.

Visitors enjoy a tour at Ozark Caverns in Lake of the Ozarks State Park.

CHALLENGES: State Parks and Historic Sites

- Although the renewal of the parks, soils and water sales tax provides a stable funding source, the park system still faces financial challenges and additional revenues sources must be identified.
- To meet demands for increased services with limited resources, the department will need to find ways to identify and implement operational efficiencies. This will include assessing staffing levels, using technology to reduce costs, managing fee structures, implementing energy-saving features, reducing the length of operational seasons, implementing seasonal restrictions on the use of some areas and controlling expenditures.
- To meet the demand for new services, the department will identify selected projects that the Missouri State Parks Foundation and other non-profit groups can support.
- The department must continue to look to the future to identify changing requirements and trends and find ways to address them.
- The state park system must find a way to help children and adults reconnect with the outdoors and nature. Without this connection, the conservation community in the state will be faced with losing much of its constituent base in the future.
- Major priority projects must be accomplished as scheduled. These include the redevelopment of Johnson's Shut-Ins State Park, the connection of Katy Trail State Park to the Kansas City area, and the redevelopment of the new Current River State Park and the Civil War site in Bates County.
- The department must help the state prepare for the sesquicentennial of the Civil War in 2011-2016.

Historic Preservation: Preserving the Heritage and Economy of Our Community

"The spirit and the direction of the Nation are founded upon and reflected in historic heritage ... the preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, esthetic, inspirational, economic and energy benefits will be maintained and enriched for future generations of Americans."

National Historic Preservation Act of 1966

Successful preservation of our state's irreplaceable heritage is the result of partnerships – partnerships between federal, state and local governments, private developers, individuals and organizations with an interest and love for the historic and cultural resources that define the character of our state.

The passage of the National Historic Preservation Act of 1966 formed a partnership between the federal government and the states to allow input by the state on federally funded or licensed undertakings that impact historic resources. Through the Section 106 Review and Compliance program, the department works closely with federal agencies on identifying historic resources in project areas, assessing the impact of the undertaking on the identified resources, and developing appropriate mitigation measures for those affected resources. Last year, more than 2,810 federal undertakings were reviewed by the department's State Historic Preservation Office (SHPO).

Preservation is increasingly becoming integrated into local community planning efforts. The Department of Natural Resources' Certified Local Government (CLG) pro-

Historic tax credits at work in Jefferson City.

Summary of Missouri State Historic Tax Credits Issued

Fiscal Year	# of Projects	Allowable Rehab Costs	Total Investment Costs	Tax Credits Issued
1998	1	$98,604	$180,019	$24,651
1999	20	$51,308,114	$55,703,270	$12,827,028
2000	32	$82,804,186	$103,871,045	$20,701,046
2001	63	$166,184,147	$200,104,297	$41,546,037
2002	93	$240,045,528	$310,955,859	$60,011,382
2003	119	$356,929,140	$434,377,644	$89,214,177
2004	179	$303,113,309	$344,597,744	$75,700,295
2005	168	$320,891,176	$376,254,903	$80,222,794
2006	230	$420,425,150	$531,605,979	$105,071,005
2007	248	$687,020,131	$901,146,233	$171,508,564
2008	337	$647,666,235	$857,553,308	$161,621,537
TOTAL	**1,482**	**$3,276,485,720**	**$4,116,350,271**	**$818,448,516**

gram provides assistance to more than 46 Missouri communities in their efforts to identify, evaluate and protect their architectural, historic and cultural resources and sites.

The CLG program helps local communities carry out preservation policies fairly and for the benefit of all the citizens of the community.

Appreciation of the value of historic resources is one way of fostering their preservation. An increasing number of Missouri's buildings, structures, objects, sites and districts have been recognized by being formally listed in the National Register of Historic Places, the nation's honor roll of historically significant resources. Missouri now has nearly 1,930 listings in the register with more than 34,500 individual resources.

Increasingly, Missouri citizens are investing in their historic resources. This year marks the 10th anniversary of the passage of the state historic rehabilitation tax credit which came into effect in 1998. Since its passage, the credits have triggered significant rehabilitation activity in the state involving the rehabilitation of over 1,482 historic buildings, costing the state $818,448,516 in credits issued, but leveraging a total private investment of $4,116,350,271.

Combined with the federal rehabilitation credits, owners and developers have a potent tool to promote investment in Missouri's historic buildings. For the past several years, Missouri has been a leader nationwide in use of the federal tax credits. In federal FY 2007, Missouri ranked number one in state activity using the program, with 189 certified projects completed, totaling $534 million in private investment.

The state has taken steps to improve and strengthen the relationship between the state and the Native American tribes that once inhabited Missouri. This year the department has sponsored a series of workshops that have brought together tribal representatives and representatives from various state and federal agencies to discuss areas of common interest and concern.

Improvements in technology have also enhanced the ability of the State Historic Preservation Office to respond to requests for information about Missouri's historic resources. Copies of National Register nominations are now available through the department's Web site and information on cultural resources is available through the department's Geographic Information System (GIS).

A major initiative this year has been the launch of the Missouri Heritage Properties Program, which is a grant program aimed at providing financial assistance to aid in the preservation and protection of historically significant publically owned buildings.

Using funds from the Nonresident Athletes and Entertainer's tax, $500,000 for grants has been awarded to help preserve historic county courthouses and facilities. Projects are under way or completed in Ralls, Cape Girardeau, Dunklin, Pemiscot, Saline, Adair, Livingston, Pettis, Newton and Nodaway counties. A second round of Missouri Heritage Properties grant funding for $1 million also has been made available.

CHALLENGES: Historic Preservation

- Increase awareness of the importance of Missouri's historic resources and encourage educational efforts and approaches for appropriate rehabilitation.
- Assist county and local governmental entities and other non-profit groups seeking funding to maintain their historic buildings.
- Continue our efforts to identify, evaluate and recognize the historic resources within the state.

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Department Director

Communications
- publications

Ombudsman Program
- ombudsmen

Policy
- fiscal notes
- science and technology
- interstate issues
- legislation
- Energy Center
- NEPA review
- policy research and analysis

Operations
- employee relations
- strategic planning

Administrative Support
- budget
- accounting
- internal audit
- facilities management
- human resources
- fiscal resources

Water Resources
Water Resources Center
- drought/flood assessment
- State Water Plan
- interstate river flow analysis
- groundwater and surface water assessments
- public wells
- groundwater level network
- water supply analysis
- dam/reservoir safety
- wetland studies
- voluntary financial
- incentives to install soil and water conservation practices
- assist 114 Soil and Water Conservation Districts

Legal
- legal issues
- Enforcement Review Board
- employee discipline hearings
- oversight of enforcement referrals
- draft and review department policies

DIVISIONS

State Parks
- 85 state parks and historic sites
- Roger Pryor Backcountry
- park rangers
- facility and visitor services
- five district offices
- planning and development
- financial/information resources
- resource management/ interpretation
- historic preservation

Geology and Land Survey
- Geological Survey
  environmental geology investigations, geologic and earthquake hazard mapping, natural hazard assessments, mineral resource assistance, geologic publication sales, McCracken Core Library, Ed Clark Museum of Missouri Geology
- Land Survey
  cadastral and geodetic surveys, state park surveys, corner remonumentation, document preservation/distribution, records repository and online land survey index

Environmental Quality
- Air Pollution
  air quality, asbestos, emissions, incineration, lead, open burning, ozone
- Environmental Investigators
- Hazardous Waste
  brownfields, disposal, e-scrap, federal facilities, petroleum storage tanks, Superfund, waste minimization
- Land Reclamation
  mining, reclamation
- Solid Waste
  composting, district grants, landfills, market development, recycling, scrap tires, transfer stations, waste reduction
- Water Protection
  animal waste, backflow prevention, boil orders, compliance review, drinking water standards, financial assistance, land disturbance, nonpoint source pollution, operator certification, public water supplies, storm water, TMDLs, wastewater, water quality standards, well construction regulations, wellhead protection

Field Services
- five regional offices
- seventeen satellite offices
- laboratory
- emergency services
- environmental services
- environmental education

BOARDS AND COMMISSIONS

Air Conservation Commission
Clean Water Commission
Dam and Reservoir Safety Council
Environmental Improvement and Energy Resources Authority
Geologic Mapping Advisory Committee
Hazardous Waste Management Commission
Inter-Agency Energy Advisory Committee
Industrial Minerals Advisory Committee
Interdepartmental Coordinating Committee on Water Quality
Interstate Mining Compact Commission
Land Reclamation Commission
Land Survey Advisory Committee
Low-Income Weatherization Assistance Policy Advisory Council
Low Level Radioactive Waste Compact Advisory Committee
Minority Environmental Literacy Advisory Committee
Missouri Advisory Council on Historic Preservation
Missouri Boundary Commission
Missouri Energy Policy Council
Missouri State Park Advisory Board
Missouri Trails Advisory Board
Petroleum Storage Tank Insurance Fund
Propane Education and Research Council
Safe Drinking Water Commission
Small Business Compliance Advisory Committee
Soil and Water Districts Commission
Solid Waste Advisory Board
State Inter-Agency Council for Outdoor Recreation
State Oil and Gas Council
State Water Plan Inter Agency Task Force
Unmarked Human Burial Consultation Committee
Water Quality Coordinating Committee
Well Installation Board

MISSOURI DEPARTMENT OF NATURAL RESOURCES

P.O. Box 176, Jefferson City, MO 65102-0176

1-800-361-4827 for department information **1-800-334-6946** for state parks information

www.dnr.mo.gov

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